

Flora Malesiana Precursores: Dipterocarpaceae

by

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Summary

Species delimitation in Dipterocarpaceae is discussed. The genus *Pentacme* DC. is reduced as a section of *Shorea* Roxb.

The following names are reduced:

Dipterocarpus penangianus Foxw. (to *D. caudatus* Foxw.), *D. speciosus* Brandis (*D. kunstleri* King), *D. trinervis* Bl. (*D. retusus* Bl.), *D. pseudofagineus* Foxw. (*D. fagineus* Vesque), *D. basilanicus* Foxw. (*D. eurynchus* Miq.), *D. subalpinus* Foxw. (*D. hasseltii* Bl.); *Anisoptera mindanensis* Foxw. and *A. oblonga* Dyer (*A. costata* Korth.), *A. brunnea* Foxw., *A. polyandra* Bl., and *A. kostermansiana* Dilmy (all to *A. thurifera* (Blco) Bl.), *Vatica blancoana* Foxw. (*V. umbonata* (Hook f.) Burck), *V. simalurensis* Sloot. (*V. venulosa* Bl.), *V. subcordata* Bl., *V. celebica* Bl. and *V. papuana* Dyer (all to *V. rassak* (Korth.) Bl.), *V. stipulata* Ridl. (*V. hullettii* (Ridl.) comb. nov.), *V. sumatrana* (Miq.) Burck and *V. wallichii* Dyer (*V. pauciflora* (Korth.) Bl.), *V. scaphifolia* Kosterm. (*V. javanica* Sloot.), *V. obtusifolia* Elm. (*V. mangachapoi* (Blco) Bl.), *V. songa* Sloot. (*V. perakensis* King); *Hopea argentea* Meijer (*H. cernua* T. et B.) *H. kelantanensis* Sym. and *H. garangbuaya* Ashton (*H. coriacea* Burck), *H. woodiana* Gutierrez (*H. malibato* Foxw.), *H. siamensis* Heim (*H. pedicellata* Brandis), *H. dolosa* Sloot. (*H. celebica* Brandis), *H. nabirensis* Sloot. (*H. iriana* Sloot.), *H. resinosa* Sym. (*H. pachycarpa* (Heim) Sym.), *Shorea flava* Meijer (*S. falciferoides* Dyer), *S. glaucescens* Meijer (*S. falciferoides* Foxw.), *S. ciliata* Foxw. (non King) (*S. astylosa* Foxw.), *S. rogersiana* Raizada and Smitinand (*S. laevis* Ridl.), *Pentacme mindanensis* Foxw. (*S. contorta* Vidal), *S. resinanegra* Foxw. (*S. longisperma* Roxb.), *S. kalunti* Merr. (*S. hopeifolia* (Heim) Sym.), *S. sororia* Sloot. (*S. assamica* Dyer), *S. plagata* Foxw. and *S. agsaboensis* Stern (*S. pauciflora* King).

Parashorea stellata Kurz and *P. lucida* (Miq.) Kurz are reinstated as separate species.

Balanocarpus heimii Sym. is transferred to a new taxon *Neobalanocarpus* gen. nov.

The identity of *Parashorea warburgii* Brandis, *Hopea dasyrrhachis* Sloot., *H. gregaria* Sloot. and *H. plagata* Vidal, *S. siamensis* Miq. and *S. virescens* Parijs is discussed.

There are 3 species of *Dipterocarpus*, 5 of *Vatica*, 8 of *Hopea* and 6 of *Shorea* described for the first time; subspecies are defined in *Dipterocarpus caudatus* Foxw., *D. palembanicus* Sloot., *Anisoptera thurifera* (Blco) Bl., *Vatica venulosa* Bl., *V. granulata* Sloot., *V. javanica* Sloot., *V. mangachapoi* (Blco) Bl., *Dryobalanops oblongifolia* Dyer, *Shorea falciferoides* Foxw., *S. parvistipulata* Heim, *S. singkawang* Miq. and *S. curtisii* Dyer.

Species delimitation

Dipterocarp taxonomy has been hampered in the past by inadequate field study: Leaf shape, tomentum density and the presence of glaucousness can change dramatically ontogenetically, while leaf and twig dimensions can vary with site conditions as well as genotypically.

Symington (Mal. For. Rec. 16, 1943) perceptively described specific and intra-specific variation in Malaya. He recognised that groups of closely allied species such as *Shorea parvifolia* Dyer, *S. leprosula* Miq., *S. lepidota* Bl., *S. dasyphylla* Foxw. and *S. macroptera* Dyer, occur commonly together in the same forest yet remain consistently distinct and easy to identify, especially at maturity, and that morphological hybrids are rare. He also recognised though that less distinct, but still nevertheless more or less discontinuous variation occurs within Malayan species as he defined them, and that this is generally allopatric in lowland species, many

(e.g. *Dipterocarpus lowii* Hook. f., *Parashorea densiflora* Sloot., *Shorea macrantha* Brandis and *S. parvifolia* Dyer) being represented by distinctly different forms, especially in Perak State in the northwest and in the eastern coastal areas. Exceptionally, two distinct forms occur sympatrically such as the two subspecies of *S. curtisii* Dyer ex Brandis, given formal description for the first time in the present paper. A third pattern of intra-specific variation occurs in Malaya among those species which transgress the perhumid to seasonal climatic boundary in the north-west, such as *Anisoptera costata* Korth. In them allopatric differentiation occurs but is much less clearly defined and is more or less continuous though not apparently clinal. Such variation becomes yet more continuous in the seasonal evergreen and more especially dry dipterocarp forests of Indo-Burma, where, for instance, *Shorea siamensis* Miq. *S. roxburghii* D. Don and *Dipterocarpus obtusifolius* Teysm. ex Miq. show great but more or less continuous variation in tomentum distribution and density which has been given taxonomic status in the past.

Less is known of the dipterocarp flora of Sumatra and Indonesian Borneo, though the pattern of variation appears to be similar to that of perhumid Malaya. The neogene basins of East Malaysia, characterised by the most diverse and least fertile soils in the region are also the present centre of dipterocarp diversity. The pattern of largely allopatric specialisation is repeated, in this case with certain rivers along the N.W. Borneo coast marking the boundaries of groups of species and geographical subspecies. Taxa appear to have rather recently fragmented into uniform segregates that constitute morphological species or subspecies; local endemism is high (for a review of this subject see Ashton Trans. II Aberdeen-Hull Symposium on Malesian ecology, 1972 pp. 35-49). Here too though some taxa appear to arise sympatrically. This is particularly evident in *Shorea* sect. *Pachycarpae* Heim: the rare *S. rotundifolia* Ashton grows together with, and completely within the geographical range of, the closely related *S. amplexicaulis* Ashton. *S. pinanga* Scheff. is polymorphic, and forms with glabrous and with pubescent leaves, and with as few as 10 or as many as 20 pairs of nerves, have been collected from nearby localities; variation in one character appears to be discontinuous, but forming a reticulum of more or less uncorrelated variation within different characters which prevents definition of intra-specific taxa. It is curious that the only apparent examples of clinal variation in Borneo occur in the riparian and valley species *Vatica umbonata* (Hook f.) Burck and *Dipterocarpus kunstleri* King. A hybrid between the former and the riparian *V. rassak* (Korth.) Bl. is also known; in Malaya *V. umbonata* varies similarly and appears to hybridise with *V. stapfiana* Ridl. The still little collected dipterocarp flora of the New Guinea lowlands appears to follow the N.W. Bornean pattern within *Hopea*, the only genus represented there by more than one species.

In the Philippines, characterised by highly fertile soils influenced by limestone and basaltic lava and ash, and by a gradually increasing seasonality towards the north-west, a different pattern of variation prevails. The dipterocarp flora is relatively poor, and local endemism low at both specific and infra-specific levels; a few species (*Dipterocarpus philippinensis* Foxw., *Shorea assamica* Dyer ssp. *philippinensis* (Foxw.) Sym., *Hopea cagayanensis* (Foxw.) Sloot.) are confined to the more strongly seasonal areas, but most are remarkably widespread in view of the range of seasonality. However, many species vary greatly and apparently continuously and clinally in the size of leaves and twigs. In *Shorea contorta* Vidal and *S. falciferoides* Dyer dimensions decline with increasing seasonality in N.W. Luzon. *Vatica mangachapoi* (Blco) Bl., *Hopea malibato* Foxw. and *Shorea polysperma* (Blco) Merr. occur throughout the Philippines on a wide range of sites but manifest great variation in relation to physiography. The leaves of *S. polysperma* and also *S. polita* Vidal are sometimes glaucous beneath, particularly in drier sites. *Shorea almon* Foxw. is considered to occur in two distinct forms in Mindanao, one

with small bullate leaves scabrid beneath, the other with larger more sparsely pubescent leaves (a pattern of variation analogous to that of *S. ovalis* (Korth.) Bl.). Field observation revealed that the two forms occur together on soft coralline limestone, and that variation appears to be continuous, though parallel ontogenetic variation necessitates a quantitative study to confirm this. It is perhaps significant that hybridisation among some Philippine dipterocarps is well known, notably between *Dipterocarpus kunstleri* King and *D. grandflorus* (Blco) Bl. and *D. elongatus* Korth.

In the absence of experimental evidence, therefore, consistent criteria for the definition of species and subspecies are essential. I have adopted the following:

1. Size differences are not by themselves sufficient to distinguish species, neither are differences of leaf size and shape combined. Differences in fruit size are likewise unreliable and rarely correlate with other characters; collections from one tree in different years often exhibit great variation. A consistent discontinuity in leaf size, where correlated with differences in androecium or gynoecium, in qualitative (but not quantitative) characters of indumentum, with qualitative characters of the twig or stipule or with a discontinuity in the range in the number of leaf nerves does constitute an adequate criterion for separating species however.

2. Subspecies can be defined where discontinuities occur in the range of dimensions of parts, in tomentum distribution and in density. However, sometimes taxa which share an unique qualitative character, especially of fruit or flower, are recognised as subspecies even though they may differ qualitatively in vegetative parts; the subspecies of *Shorea ovalis* (Korth.) Bl. may serve as an example.

Dipterocarpus

Dipterocarpus obtusifolius TEYSM. ex MIQ. Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 214; DC. Prodr. 16, 2 (1868) 608; WALP. Ann. 7 (1868) 377; DYER Fl. Br. Ind. 1 (1874) 295; KURZ Fl. Burm. 1 (1877) 115; BRANDIS J. Linn. Soc. Bot. 31 (1895) 7, 27; Ind. Trees (1907) 65, 701; GUERIN in LECOMTE, Fl. Gén. I.-C. 1 (1910) 358; TARDIEU in id. Suppl. 1 (1943) 338; TROUP Silv. Ind. Trees (1921) 39; CRAIB Fl. Siam. Enum. (1925) 136; PARKER Ind. For. Rec. 16 (1931) 9; PARKINSON Burma For. Bull. 27 (1932) 23; SYM Mal. For. Rec. 16 (1943) 184. — *D. vestitus* WALL. Cat. (1828) 954; WALP. Rep. 5 (1845) 124; DC. Prodr. 16, 2 (1868) 614 *nomen nudum*; ex DYER Fl. Br. Ind. 1 (1874) 295 desc.; BRANDIS J. Linn. Soc. Bot. 31 (1895) 27. — *D. punctulatus* PIERRE Fl. Coch. 3 (1892) 221; BRANDIS J. Linn. Soc. Bot. 31 (1895) 29; GUERIN in LECOMTE Fl. Gén. I.-C. 1 (1910) 357.

HOLOTYPE: Teysmann H.B. 5918, Kanburi, Thailand (U; syntypes L, BO, K).

Var. *subnudus* RYAN & KERR J. Siam. Soc. 8 (1911) 3.

LECTOTYPE: Kerr 17717, Kao Kuap, Krat, Thailand (K).

Var. *vestitus* (WALL. ex DYER) SMITINAND Thai For. Bull. 1 (1954) 51.

HOLOTYPE: Wallich 954, Martaban (K).

Var. *glabricalyx* SMITINAND Thai For. Bull. 1 (1954) 51.

ISOHOLOTYPE: R.F.D. 7739 (Dec. 462) Koke Dindaeng, Wang Sapoong, Loie, Thailand (K).

Twigs, inflorescences, flower calyx, outside of corolla, leaf buds and petioles densely pale fulvous to buff hirsute or glabrous; leaf beneath and midrib above shortly densely evenly $\pm$ persistently buff pubescent.

A characteristic and frequently gregarious fire-resistant component of the Dry Dipterocarp (savanna) forest. Very variable, especially in the amount and density of tomentum; the more glabrous form (var. *subnudus*) prevails in the more humid areas including N.W. Malaya; var. *vestitus* is tomentose on all parts, whereas var.

glabricalyx differs only in the glabrous flower calyx. In view of the extreme variability of this species (cf. *S. siamensis*) I do not recognise the varieties as distinct taxonomic entities.

Dipterocarpus caudatus FOXW. Philip. J. Sc. 13 (1918) Bot. 177; *ibid.* 67 (1938) 256; MERR. En Philip. 3 (1923) 89; SLOOT. Bull. Jard. Bot. Btzig III, 8 (1927) 302, 303.

Ssp. **caudatus** Lectotype: FB 21193, Barrio Hibatac, Camarines, Luzon (K).

Leaf bud and stipule outside shortly densely pale buff pubescent, parts otherwise glabrous. Twig 1–3 mm ϕ apically, slender, $\pm$ compressed, smooth, with slightly swollen amplexicaul stipule scars. Bud 8–17 by 2–3 mm, narrow falcate or linear; apex tufted with slightly longer hairs arising from the outer surface. Stipule c. 3.5 by 0.5 cm., linear, obtuse. Leaves 7–11 by 3.5–5 cm, broadly elliptic, prominently plicate; base broadly cuneate; acumen to 1.2 cm long, prominent, narrow; nerves 9–12 pairs, prominent, at 35°–45°; petiole 1–1.5 cm long, slender. Raceme to 12 cm long, slightly compressed, unbranched or singly branched, the flowers secund, few; bracts unknown. Flower bud to 3 by 0.8 cm. Calyx and corolla typical, calyx puberulent. Stamens c. 30, shorter than the style; filament short; anthers short, linear, tapering; appendage to connective slightly shorter than anther, stout at base, tapering. Ovary conical, densely pubescent; style and stylopodium narrowly cylindrical, somewhat stouter and more densely tomentose in the basal half. Fruit calyx glabrous; tube c. 2 cm long and ϕ , slightly obovoid, glabrous, minutely lenticellate, tapering gradually to the pedicel, c. 1 cm. ϕ at the neck; 2 longer calyx lobes to 14 by 3 cm, oblong, 3-nerved, obtuse, rather abruptly narrowing to c. 5 mm broad at base; 3 shorter lobes 4–8 by 3–4 mm, variable, strongly recurved and revolute.

DISTR. Malesia: S.E. Philippines (Mindanao, Luzon).

Ssp. **penangianus** (FOXW.) *stat. nov.* — *D. penangianus* FOXW. Mal. For Rec. 10 (1932) 72; SYM. Mal. For. Rec. 16 (1943) 185; ASHTON, Man. Dipt. Brun. (1963) 43; *ibid* Suppl. (1968) 16.

TYPE: SFN 3484 (Haniff) Mt. Olivia, Penang (SING, K).

Twig, petiole, raceme, midrib and nerves shortly sparsely fugaceous pubescent, twigs sometimes densely persistently so. Leaves narrowly elliptic, applanate, with narrowly cuneate base, hardly prominent nerves beneath and 1.5–2.5 cm long petiole.

DISTR. Malesia: Malaya (Perak, Penang, W. & E. Johor, Kelantan, Pahang), Singapore, Karimun, Mursala, Borneo (Sarawak N.E. of river Rejang; S.E. Sabah).

I do not consider that the small difference of tomentum and leaf shape are sufficient to justify maintaining these taxa as separate species, especially in view of their distinctive shared linear-falcate bud and obovoid to obturbinate fruit calyx. Malayan collections are distinguished from Bornean by their denser and more persistent indumentum on twigs, and by their prominently lenticellate fruit calyx tube. I have selected the Kew isoholotype as lectotype as the holotype is no longer in the Philippine National Herbarium and is presumed destroyed.

Dipterocarpus hasseltii BL. Fl. Jav. 2 (1829) 22; KORTH. Kruidk. (1841) 65; WALP. Rep. 5 (1845) 123; MIQ. Fl. Ind. Bat. 1, 2 (1859) 497; Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 85; DC. Prodr. 16, 2 (1868) 609; BURCK. Ann. Jard. Bot. Btzig 6 (1887) 196; BRANDIS J. Linn. Soc. Bot. 31 (1895) 30; K. et V. Bijdr. (1900) 109; RIDL. J. Str. Br. R. As. Soc. 33 (1900) 42; *ibid.* 34 (1900) 94; MOLL & JANSSONIUS Mikrogr. Holz. (1906) 359; KOORD. Exk. Fl. Java. 2 (1912) 620; BAKER f. J. Bot. 62 (1924) 10; CRAIB Fl. Siam. Enum. 1 (1925) 135; HEYNE Nutt. Pl. ed. 2, 2 (1927) 1096, 1097; SLOOT. Bull. Jard. Bot. Btzig III, 8 (1927) 280; *ibid.* III, 16 (1940) 436; FOXW. Mal. For. Rec. 10 (1932) 67; Philip. J. Sc. 67 (1938) 251; BURK. Dict. 1 (1935) 844; SYM. Mal. For. Rec. 16 (1943) 180; SMITINAND Thai For. Bull. 4 (1958) 35; BACKER & BAKH. f. Fl. Jav. 1 (1936) 329; MEIJER & WOOD Sab. For. Rec. 5 (1964) 255. — *D. tampurau* KORTH. Kruidk. (1841) 63; WALP. Rep. 5 (1845)

123; BL. Mus. Bot. 2 (1852) 36; MIQ. Fl. Ind. Bat. 1, 2 (1859) 498; Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 85; DC. Prodr. 16, 2 (1868) 609; DYER J. Bot. 12 (1874) 103; BURCK Ann. Jard. Bot. Btzig 6 (1887) 198 *p.p.*; BRANDIS J. Linn. Soc. Bot. 31 (1895) 29; MERR. En. Born. (1921) 400; SLOOT. Bull. Jard. Bot. Btzig III, 8 (1927) 292; HEYNE Nutt. Pl. ed. 1, 3 (1917) 274; *ibid.* ed. 2, 2 (1927) 1098; ASHTON Gard. Bull. Sing. 20 (1963) 234. — *D. quinquegonus* BL. Mus. Bot. 2 (1852) 36; WALP. Ann. 4 (1851) 335; MIQ. Fl. Ind. Bat. 1, 2 (1859) 497; Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 85; MERR. En. Born. (1921) 400. — *D. pentagonus* DC. Prodr. 16, 2 (1868) 610; DYER J. Bot. 12 (1874) 104; BURCK Ann. Jard. Bot. Btzig 6 (1887) 199; BRANDIS J. Linn. Soc. Bot. 31 (1895) 34; SLOOT. Bull. Jard. Bot. Btzig III, 8 (1927) 282. — *D. lamponus* SCHEFF. Nat. Tijd. N. I. 31 (1870) 146; DYER J. Bot. 12 (1874) 102; BURCK Ann. Jard. Bot. Btzig 6 (1887) 197; BRANDIS J. Linn. Soc. Bot. (1895) 31; HEYNE Nutt. Pl. 1, 3 (1917) 272; ASHTON Gard. Bull. Sing. 20 (1963) 236 in obs. sub *D. gracilis*. — *D. balsamiferus* BL. Mus. Bot. 2 (1852) 37; MIQ. Fl. Ind. Bat. 1, 2 (1859) 498; Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 85; DC. Prodr. 16, 2 (1868) 613; DYER J. Bot. 12 (1874) 108; BURCK Ann. Jard. Bot. Btzig 6 (1887) 203; BRANDIS J. Linn. Soc. Bot. 31 (1895) 40; K. et. V. Bijdr. (1900) 111; MOLL & JANSONIUS Microgr. Holz (1906) 357; HEYNE Nutt. Pl. ed. 2, 2 (1927) 1096. — *D. trinervis* (non BL.) FOXW. Philip. J. Sc. 6 (1911) Bot. 247; *ibid.* 13 (1918) Bot. 177; MERR. En. Philip. 3 (1923) 91. — *D. subalpinus* FOXW. in ELM. Leaf. Philip. Bot. 6 (1913) 1950; Philip. J. Sc. 13 (1918) Bot. 177; *ibid.* 67 (1938) 255; SLOOT. Bull. Jard. Bot. Btzig III, 8 (1927) 283.

I agree with Merrill (En. Philip.) in reducing *D. subalpinus* FOXW., based on Elmer 13531, Cabadbaran, Mt. Urdaneta, Agusan here. Foxworthy (1938) claimed that *D. subalpinus* differed from *D. hasseltii* in having smaller leaves and fruit without the distinctive large suborbicular shorter calyx lobes, in this resembling *D. gracilis* BL. The problem is confounded by the frequently unusually sparsely tomentose leaves of *D. gracilis* in the Philippines, especially at higher altitudes where *D. subalpinus* appears to prevail. However, the specimens presently available convince me that Philippine material is within the range of variation of *D. hasseltii* from other parts of its range.

Dipterocarpus retusus BL. Cat. (1823) 77; Verh. Bat. Gen. K. W. (1823) 178; Bijdr. 5 (1825) 223; Fl. Jav. 2 (1829) 14; WALP. Rep. 5 (1845) 122; MIQ. Fl. Ind. Bat. 1, 2 (1859) 497; Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 85; DC. Prodr. 16, 2 (1868) 609; DYER J. Bot. 12 (1874) 102; BURCK Ann. Jard. Bot. Btzig 6 (1887) 197; BRANDIS & GILG in E. & P. Pfl. Fam. ed. 1, 3, 6 (1895) 256; BRANDIS J. Linn. Soc. Bot. 31 (1895) 30; K. & V. Bijdr. (1900) 112; KOORD. Exk. Fl. Java, 2 (1912) 21; GILG in E. & P. Pfl. Fam. ed. 2, 21 (1925) 251; HEYNE, Nutt. Pl. ed. 2, 2 (1927) 1097; SLOOT. Bull. Jard. Bot. Btzig III, 8 (1927) 286; *ibid.* III, 16 (1940) 435; FOXW. Mal. For. Rec. 10 (1932) 69; SYM. Mal. For. Rec. 16 (1943) 187; BACKER & BAKH. f. Fl. Jav. 1 (1963) 329. — *Dipterocarpus trinervis* BL. Cat. (1823) 78; Verh. Bat. Gen. K. W. 9 (1823) 178; Bijdr. (1825) 223; Fl. Jav. 2 (1829) 11; KORTH. Kruidk. (1841) 61; WALP. Rep. 5 (1845) 122; LINDLEY Veg. King. (1846) 393; SCHNIZLEIN Ic. 3 (1857) t 213; MIQ. Fl. Ind. Bat. 1, 2 (1859) 496; Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 85; DC. Prodr. 16, 2 (1868) 608; SCHEFF. Nat. Tijd. N. I. 31 (1870) 346; BAILLON Hist. Pl. 4 (1873) 204; Dict. Bot. 1 (1878) 562; Tr. Bot. Med. Pharm. 2 (1884) 816; DYER J. Bot. 12 (1874) 102; BURCK Ann. Jard. Bot. Btzig 6 (1887) 195; BRANDIS & GILG in E. & P. Pfl. Fam. 1, 3, 6 (1895) 256; BRANDIS J. Linn. Soc. Bot. 31 (1895) 29; K. et V. Bijdr. (1900) 105; MOLL & JANSSONIUS Microgr. Holz (1906) 354; KOORD. Ex. Fl. Java, 2 (1912) 620; HEYNE Nutt. Pl. ed. 1, 3 (1917) 274; *ibid.* ed. 2, 2 (1927) 1098; GILG in E. & P. Pfl. Fam. ed. 2, 21 (1925) 251; SLOOT. Bull. Jard. Bot. Btzig III, 8 (1927) 284; *ibid.* III, 16 (1940) 436; BACKER & BAKH. f. Fl. Jav. 1 (1963) 329. — *D. trinervis* var. *elegans* BL., var. *canescens* BL. Fl. Jav. 2 (1829) 13; HASSK. Pl. Jav. Rar. (1848) 270; MIQ. Fl. Ind. Bat. 1, 2 (1859) 497; DC. Prodr. 16, 2 (1868) 609; DYER J. Bot. 12 (1874) 102; BURCK Ann. Jard. Bot. Btzig 6 (1887) 196. — *D. spanoghei* BL. Fl. Jav. 2 (1829) 16; WALP. Rep. 5 (1845) 122; MIQ. Fl. Ind. Bat. 1, 2 (1859) 497; Ann. Mus. Bot. Lugd.-Bat. (1867) 85; DC. Prodr. 16, 2 (1868) 609; BURCK Ann. Jard. Bot. Btzig 6 (1887) 198; HEYNE Nutt. Pl. ed. 2, 2 (1927) 1097. — *D. macrocarpus* VESQUE C. R. Ac. Paris 78 (1874) 627; J. Bot. 12 (1874) 153; DYER J. Bot. 12 (1874) 4; PARKER Ind. For. Rec. (Bot.) 20, 15 (1934) 3. — *D. spanoghei* BL. var. *cordata* BURCK Ann. Jard. Bot. Btzig 6 (1887) 198. — *D. pubescens* K. & V. Bull. Inst. Bot. Btzig 2 (1899) 2; Bijdr. 5 (1900) 115; MOLL & JANSSONIUS Microgr. Holz (1906) 359; KOORD. Exk. Fl. Java 2 (1912) 621; HEYNE Nutt. Pl. ed. 1, 3 (1917) 274; *ibid.* ed. 2, 2 (1927) 1097. — *D. tonkinensis* A. CHEV. Bull. Econ. Indoch. 20 (1918) 798; TARDIEU in LECOMTE Fl. Gen. I.-C. Suppl. 1 (1943) 341.

I do not recognise Blume's two species *D. retusus* (Syntypes: Blume 1082a G. Salak (L); Van Hasselt s.n. sub. HLB 902,146–196,–197, W. Java (L)) and *D. trinervis* (Syntypes: Junghuhn s.n. sub. HLB 902 146–219,–230, *loc. incert.*, Java (L); Blume s.n. sub. HLB. 902,146–218,–234, G. Salak (L); Van Hasselt

s.n. sub. H.L.B. 902,146–241, G. Poelasari W. Java (L)). *D. trinervis* is said to differ in being persistently buff pubescent on twigs, panicles and often petiole. The two grow together within a single forest in Java; their similarity in other characters, and the variability of the tomentum convince me of their conspecificity. I reduce *D. macrocarpus* VESQUE (Syntypes: Griffith s.n., Kew dist. no 733, Kujoo, Lakhimpur, Assam (P, K) of Assam, north Burma and Thailand and *D. tonkinensis* CHEV. (Holotype: Chevalier 37387, Cuyen Guang, Tonkin) of Tonkin here for the first time. They both resemble *D. trinervis* but the tomentum is somewhat longer and they remain persistently pubescent on the leaf beneath; furthermore PARKER described *D. macrocarpus* var. *glaber* on Parkinson 344, Myityina which differs in no important respect from the glabrous forms *D. retusus*.

This species, as presently understood, has an interesting distribution: At the extremities of its range in mainland Asia and on Lombok and Sumbawa it occurs in a seasonal climate down almost to sea level and is relatively tomentose. In Malaya and W. Java it is confined to altitudes above 800 m. and in the former is uniformly glabrescent but for the buds and corolla.

D. littoralis BL. is clearly a segregate from the widespread *D. retusus*, endemic to the lowland forests of Noesa Kambangan Island, Java; I maintain it as a species. It would appear that the ecological and geographical distribution, and diversification, of the two must be explained in terms of regional Pleistocene history.

Dipterocarpus kunstleri KING J. R. As. Soc. Beng. Sc. 62, 2 (1893) 96; BRANDIS J. Linn. Soc. Bot. 31 (1895) 37; BRUHL & KING Ann. R. Bot. Gard. Calc. 5, 2 (1896) 148; RIDL. Fl. Mal. Pen. 1 (1922) 217; HEYNE Nutt. Pl. ed. 2, 2 (1927) 1094, 1096; SLOOT. Bull. Jard. Bot. Btzig III, 8 (1927) 327; FOXW. Mal. For. Rec. 10 (1932) 83; BURK. Dict. 1 (1935) 844; SYM. Mal. For. Rec. 16 (1943) 182. — *D. speciosus* BRANDIS J. Linn. Soc. Bot. 31 (1895) 38; PERKINS Fragm. Fl. Philip. (1904) 22; FOXW. Philip. J. Sc. 6 (1911) Bot. 250; *ibid.* 13 (1918) 178; *ibid.* 67 (1938) 261; MERR. En. Philip. 3 (1923) 90; SLOOT. Bull. Jard. Bot. Btzig III, 8 (1927) 265; SLOOT. ex WOOD Gard. Bull. Sing. 17 (1960) 486; Reinwardtia 5 (1961) 462; ASHTON Man. Dipt. Brun. (1964) 31; *ibid.* Suppl. (1968) 14; MEIJER & WOOD Sab. For. Rec. 5 (1964) 246.

In the Philippines the species is very variable; in some collections the fruit calyx is continuously ribbed from base to apex and even winged, suggesting hybridisation with *D. grandiflorus* (BLCO) BL.; in others the twigs and petioles are densely fulvous pilose as in *D. elongatus* KORTH., which grows with it there. *D. speciosus* BRANDIS is based on Vidal 2160, in fruit (K) from Luzon, a specimen with tomentum typical of *D. kunstleri* KING and fruit similar though with narrower, more continuous ribs. I see no satisfactory solution other than to unite the two species.

In N.E. and E. Borneo the calyx tube is more or less obtusely ribbed and tuberculate distally, and the calyx lobes often (not always) short or even rudimentary. Individual trees observed in the field are rather constant in the lobe length, but geographical variation appears continuous and to some extent clinal, the lobes becoming shorter towards the S.E. limits of its range. I cannot therefore recognise distinct varieties meriting taxonomic status.

Dipterocarpus fagineus VESQUE C.R. Ac. Sc. Paris 78 (March 1874) 625; J. Bot. 12 (1874) 149; DYER J. Bot. 12 (1874) 152; BURCK Ann. Jard. Bot. Btzig 6 (1887) 200; KING J. R. As. Soc. Beng. Sc. 62, 2 (1893) 94; BRANDIS J. Linn. Soc. Bot. 31 (1895) 33; BURKILL J. Str. Br. R. As. Soc. 81 (1920) 51, 53; MERR. En. Born. (1921) 398; RIDL. Fl. Mal. Pen. 1 (1922) 216 p.p.; SLOOT. Bull. Jard. Bot. Btzig III, 8 (1927) 318; FOXW. Mal. For. Rec. 10 (1932) 80; SYM. Kew Bull. (1937) 318; Mal. For. Rec. 16 (1943) 177; BROWNE For. Tr. Sarawak & Brunei (1955) 108; ASHTON Man. Dipt. Brun. Suppl. (1968) 14. — *D. prismaticus* DYER J. Bot. 12 (Apr. 1874) 104; *ibid.* (May 1874) 152. — *Duvaliella problematica* HEIM Bull. Soc. Linn. Paris, 2 (1891) 1009; Rech. Dipt. (1892) 72; BRANDIS & GILG in E. & P. Pfl. Fam. ed. 1, 3, 6 (1895) 263; GILG in *ibid.* 2, 21 (1925) 258. — *Dipterocarpus pseudofagineus* FOXW. Mal. For. Rec. 10 (1932) 82; SYM. Mal. For. Rec. 16 (1943) 186.

The holotype of *D. fagineus*, Beccari 3008 (P) is from Sarawak, where the species is rare in hill forests. In Malaya it also occurs in the hills of Perak and Penang island. Collections from low altitudes in coastal Pahang and Trengganu, and also Perak, previously generally described as *D. pseudofagineus* FOXW. (Holotype: Kep 25511, Keledong Saiong F.R., Perak (KEP)) have longer leaves with more nerves, generally glaucous beneath, and have fruit calyx ribs confined to the distal half. Symington, whose opinions I have learned to respect, considered these as distinct species. There is no discontinuity, among collections presently available, between these lowland and hill forms however, and they appear to occur together in the Keledong Saiong range in Perak. I therefore feel compelled to unite them.

Dipterocarpus glabrigemmatius *sp. nov.* — *D. sp.* ASHTON Man. Dipt. Brun. Suppl. (1968) 19.

D. grandiflori (BLCO) Bl. *affinis*, sed staminibus 15 lamina subtus sparsim pubescenti gemma glabra differt.

Midrib and nerves sparsely pubescent, other vegetative parts glabrous. Twig c. 3 by 2 mm ϕ , somewhat compressed and ribbed, lustrous; stipule scars slender, pale, hardly raised. Leaf bud to 6 by 4 mm, acute. Stipule unknown. Leaves 6–9 by 4.5–6 cm, broadly ovate; margin sinuate distally; base obtuse; acumen to 5 mm long, short, broad; nerves 10–11 pairs, prominent beneath, at 45°–60° near the base, straight but curving near the margin; midrib applanate above, prominently terete beneath; tertiary nerves subscalariform; petiole 1.5–2.5 cm long, slender, drying rugose. Raceme to 10 cm long, to 1 mm ϕ at base, axillary, unbranched, glabrous. Flower bud to 25 by 12 mm. Calyx glabrous, prominently 5-winged; corolla typical. Stamens 15, subequal; filaments compressed at base, tapering; anthers linear, 2–3 times as long as filaments; appendage to connective almost as long as anther, filiform, tapering. Ovary ovoid, small, pubescent; style c. 5 times length of ovary, pubescent except at apex. Fruit unknown.

HOLOTYPE: S. 23849, Bukit Raya, Kapit, Sarawak (K).

OTHER COLL: Sarawak: S. 22339, Bt. Leran, S. Miah, Rejang; Smythies s.n., S. Bena, Sut, Baleh.

D. grandiflorus is confined to seasonally dry habitats: in seasonal evergreen dipterocarp forests of Indo-Burma and N.W. Luzon, dry ridges in Malaya and the everwet parts of the Philippines, and dry coastal hills in N.E. Sabah. Our species, whose leaves and probably fruit (judging from the flower calyx) bear a marked resemblance to those of *D. grandiflorus*, is a rare tree on moist clay soils in everwet Central Sarawak. The 30 stamens and distinctive densely greyish puberulent bud of *D. grandiflorus* serves at once to distinguish it.

Dipterocarpus palembanicus SLOOT. Bull. Jard. Bot. Btzig III, 8 (1927) 336.

Ssp. **palembanicus** SYM. Mal. For. Rec. 16 (1943) 185; ASHTON Man. Dipt. Brun. Suppl. (1968) 16 p.p. — *D. alatus* (non ROXB.) FOXW. Mal. For. Rec. 10 (1932) 82.

LECTOTYPE: F.R.I.T.134 (fruit), Gunong Megang, Lematang Hilir, Palembang, Sumatra (BO).

Twig, leaf bud and stipule outside densely fulvous hirsute; petiole, midrib above and leaf beneath densely shortly puberulent; caducous on twigs and petioles, otherwise persistent. Leaves 10–14 by 5–9 cm, broadly elliptic to ovate; petiole 2–3 cm long. Fruit calyx tube to 3.5 by 1.5 cm, narrowly ellipsoid, tapering gradually to the base and the c. 1 cm ϕ neck; broadly 5-winged, the wings thin, to 8 mm broad, $\pm$ obtuse or subcordate at base, with the margin folded over frequently at maturity.

DISTR. Malesia: Malaya (Trengganu, C. Johore), Singapore, Sumatra (Palembang), Borneo (C. Sarawak).

Ssp. **borneensis** *ssp. nov.* — *D. palembanicus* (non SLOOT.) ASHTON Man. Dipt. Brun. (1963) 42; MEIJER & WOOD Sab. For Rec. 5 (1964) 266.

Ramuli petioli costa media costis laterales subtusque conferte breviter badio pubescentes; ramuli caduci partes aliter persistentes. Gemmae stipulae petiolique persistenti hirsuti lamina sparsim fugace pubescens. Lamina 6–11 x 3–6 cm oblonga vel ovata costis lateralibus utrinsecus 12–14; petiolo c. 15 cm longo. Tubus calycis in fructu 4.5 x 20 cm alis lateralibus 5, –15 mm latis undulatis basim et apicem versus auriculatis.

DISTR. N.E. Borneo, C. and N.E. Sarawak, E. Sabah to Nunukan. In lowland Mixed Dipterocarp forests, sometimes occurring with *ssp. palembanicus*.

HOLOTYPE: San A 1747, Beaufort, Sabah (L).

OTHER COLL.: Sarawak S. 22204, 22228, Bt. Raya, Kapit; S. 15106, Ulu Segan, Bintulu.

Dipterocarpus fusiformis *sp. nov.*

D. mundi SLOOT. affinis sed gemma persistenti alutaceo velutinata lamina subtus sparsim puberulens differt.

Large tree. Young parts densely buff velutinate, persistent on leaf buds and stipule outside, becoming sparse yet $\pm$ persistent on twigs, petiole and leaf under-surface, elsewhere caducous. Twigs c. 2 mm ϕ apically, slender, terete, $\pm$ verrucose. Buds to 15 by 3 mm, linear, lanceolate; stipule to 30 by 6 mm, lanceolate, acute. Leaves 7–17 by 3–7 cm, elliptic or narrowly ovate, coriaceous; base cuneate or obtuse; acumen to 12 mm long, slender, prominent; nerves 13–17 pairs, slender but prominent beneath, ascending at 30°–40°; tertiary nerves densely scalariform, evident but hardly elevated beneath; petiole 2–2.6 cm long, slender. Complete inflorescences unknown; inflorescences singly branched or unbranched, axillary. Flowers unknown. Fruit pedicel c. 1 mm long, short; calyx tube to 28 by 18 mm, ellipsoid, with 5, to 6 mm broad, straight incrassate wings or narrow ridges, continuous from base to apex but generally broader in the distal half; 2 longer lobes to 10 by 2.6 cm, broadly spatulate, obtuse, c. 7 mm wide at base; 3 shorter lobes to 5 mm long, suborbicular, subrevolute.

DISTR. N.E. Borneo; rare on undulating well drained fertile soils in Mixed Dipterocarp forest.

HOLOTYPE: San 39170, Mile 81, Labuk Road, Sandakan (L).

OTHER COLL.: San 63787, S. Sipit, Semporna; San 70858, 70903, Ulu Segama, Lahad Datu; San 15279, Kalabakan, Tawau; San 17173, 16452, Balong, Tawau.

Clearly closely allied to *D. mundus* SLOOT. of the Central Bornean hills, a species which is conspicuously glabrous but for its corolla, ovary, and the inside of its stipules. The two species are therefore very different in appearance; flowers are still awaited and may provide further differences.

Dipterocarpus eurynchus MIQ. Sum. (1862) 485; Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 85; D. C. Prodr. 16, 2 (1868) 613; WALP. Ann. 7 (1868) 377; BURCK Ann. Jard. Bot. Btzig 6 (1887) 203; BRANDIS J. Linn. Soc. Bot. 31 (1895) 40; SLOOT. Bull. Jard. Bot. Btzig III 8 (1927) 273, 302; ASHTON Gard. Bull. Sing 20 (1963) 238; Man. Dipt. Brun. (1964) 30; *ibid.* Suppl. (1968) 14. — *D. eurynchoides* SCHEFF. Nat. Tijd. N. I. 31 (1870) 346; BURCK Ann. Jard. Bot. Btzig 6 (1887) 203; BRANDIS J. Linn. Soc. Bot. 31 (1895) 40; SLOOT. Bull. Jard. Bot. Btzig III, 8 (1927) 273, 302. — *D. appendiculatus* SCHEFF. Nat. Tijd. N. I. 31 (1870) 347; *ibid.* 32 (1873) 407; DYER J. Bot. 12 (1874) 104 *p.p.*; BURCK Ann. Jard. Bot. Btzig 6 (1887) 200 *p.p.*; BRANDIS Linn. Soc. Bot. 31 (1895) 34 *p.p.*; MERR. En. Born. (1921) 397 *p.p.*; HEYNE Nutt. Pl. ed. 2, 2 (1927) 1094; SLOOT. Bull. Jard. Bot. Btzig III, 8 (1927) 326; Reinwardtia 5 (1961) 458; FOXW. Mal. For. Rec. 10 (1932) 83 *in obs.*; SYM. Mal. For. Rec. 16 (1943) 167. — *D. micropterus* DYER in SLOOT. Reinwardtia 5 (1961). 458 *nomen pro syn.* — *D. basilanicus* FOXW. Philip. J. Soc 13 (1918) Bot. 179; *ibid.* 67 (1938) 259; MERR. En. Philip. 3 (1923) 88.

DISTR. Malesia: Malaya (E. coast, Trengganu to N.E. Johor), Sumatra (E. Aceh, Langsa), P. Singkep, Banka, Borneo (W. Borneo, Sarawak, Brunei), S. Philippines (rare).

A polymorphic species, I recognise one distinctive and well collected segregate, *D. ochraceus* MEIJER, as a separate species. Others, presently ill-understood, may eventually deserve taxonomic definition: The few Malayan and Sumatran collections, for instance, have markedly larger leaves with longer petioles, and collections from Gunong Angsi, Negri Sembilan (including Kep. 23788, quoted by Symington (1943) as a possible hybrid between *D. gracilis* and *D. costatus*) come close to *D. ochraceus*. *D. basilanicus* FOXW. (Lectotype: FB 18895, Mt. Basilan, Philippines (K)), conforms more closely than these to N.E. Bornean collections and the type and must therefore be reduced. *D. eurynchus* is apparently derived from the widespread *D. costatus* GAERTN. f. of seasonal S.E. Asia as may be the closely similar *D. glandulosus* THW. of Ceylon.

Dipterocarpus perakensis *sp. nov.* — *D. alatus* (non ROXB.) FOXW. Mal. For. Rec. 10 (1932) 89 p.p.; SYM. Mal. For. Rec. 16 (1943) 166.

D. eurynchus MIQ., *D. ochraceus* MEIJER, *D. philippinensis* FOXW. affinis sed tubo calycis in fructu alis 5 lateralibus – 8 mm latis partibus glabris ovario excepto.

Large tree. Parts glabrous but for the cream puberulent ovary apex. Twigs c. 2 mm. ϕ apically, much branched, blackish. Buds to 9 by 2 mm, lanceolate, drying blackish; stipules unknown. Leaves 4–7 by 8–13 cm, elliptic, coriaceous; base broadly cuneate to obtuse; apex shortly acuminate; nerves densely scalariform, slightly elevated beneath; petioles 1.5–3.2 cm long, slender. Flowers and inflorescence unknown. Fruit pedicel to 2 by 1 mm; calyx tube to 2.3 cm ϕ , subglobose with 5 prominent continuous to 8 mm wide coriaceous wings; 2 longer lobes to 12 by 3 cm, oblong-lorate, obtuse, tapering abruptly to c. 8 mm wide at the revolute base; 3 shorter lobes to 5 by 5 mm, suborbicular, subrevolute, small.

DISTR. N. W. Malaya; Very local in lowland Mixed Dipterocarp forest on the coastal hills of Dindings, Perak and on Pangkor and Penang Islands.

HOLOTYPE: Kep 76716; South Pangkor F.R., Dindings, Perak, Malaya (KEP).

OTHER COLL.: Kep 54231, 76547, S. Pangkor F.R.; KEP. 24555 'Ipoh'; Curtis 1560, Burkill s.n. July 1918, Penang Hill.

A segregate from *D. eurynchus* MIQ. and *D. costatus* GAERTN. f., clearly distinguished by the relatively broad wings on the fruit calyx tube and conspicuous lack of tomentum.

Anisoptera

The problem of *A. costata* Korth. and *A. thurifera* (Blco) Bl.

The type section of *Anisoptera* KORTH. includes two distinct but obviously related vicarious species: *A. curtisii* DYER ex KING of Malaya with 25 stamens and *A. grossivenia* SLOOT, of Borneo with c. 36; also *A. megistocarpa* SLOOT. of Malaya with c. 60 stamens which shares the golden peltate leaf undersurface. The peat swamp species *A. marginata* KORTH. differs in having but 25 stamens and a small epilose few-nerved leaf, while *A. reticulata* ASHTON of the N.E. Borneo hills resembles the latter but has 35 stamens. These five are confined to the perhumid area of western Malesia, are rather constant intraspecifically and are well defined from one another.

In the seasonal extremities of the sectional range, however, more variable species occur.

Anisoptera costata KORTH. Kruidk. 3 (1841) 67; BL. Mus. Bot. Lugd-Bat. 2 (1852) 42; MIQ. Fl. Ind. Bat. 1, 2 (1859) 501; Ann. Mus. Bot. Lugd. Bat. 3 (1867) 85; D. C. Prodr. 16, 2 (1868) 615; PIERRE in LANESS. Pl. util. colon. Franc. (1886) 298; BURCK

Ann. Jard. Bot. Btzig 6 (1887) 220; BRANDIS J. Linn. Soc. Bot. 31 (1895) 43; RIDL. Agr. Bull. Str. & F.M.S. 1 (1901) 60; Str. Br. R. As. Soc. 54 (1910) 25 p.p.; Fl. Mal. Pen. 1 (1922) 218 p.p.; MERR. En. Born. (1921) 400; SLOOT. Bull. Jard. Bot. Btzig 3, 8 (1926) 7; Reinwardtia 2 (1952) 8 p.p.; THORENAAR Med. Proefst. Boschw. 16 (1926) 106; HEYNE Nutt. Pl. ed. 2, 2 (1927) 1098; FOXW. Mal. For. Rec. 3 (1927) 79; *ibid.* 10 (1932) 97; SYM. Gard. Bull. S.S. 8 (1934) 9; Mal. For. Rec. 16 (1943) 204; SLOOT. *apud* HOLTHUIS & LAM Blumea, 5 (1942) 214; WYATT-SMITH Mal. For. 18 (1955) 74; BACKER & BAKH. f. Fl. Jav. 1 (1963) 330; ASHTON Man. Dipt. Brun. (1964) 11; *ibid.* Suppl. (1968) 5; MEIJER & WOOD Sab. For. Rec. 5 (1964) 293.—*Anisoptera oblonga* DYER Fl. Br. Ind. 1 (1874) 301; PIERRE Fl. Coch. 3 (1892) 235, 236; BRANDIS J. Linn. Soc. Bot. 31 (1895) 42; Ind. Trees (1907) 67; GUERIN in LECOMTE Fl. Gén. I-C. 1 (1912) 369; GAMBLE Man. Ind. Timb. (1922) 75; SYM. Gard. Bull. S. S. 8 (1934) 10; Mal. For. Rec. 16 (1943) 208; PARKINSON Ind. For. Rec. 20 (1935) 7.—*Shorea nervosa* KURZ Rep. Pegu App. A. (1875) XVIII, *nomen*; Fl. Burm. 1 (1877) 110.—*Anisoptera cochinchinensis* PIERRE in LANESS. Pl. Util. Colon. Franc. (1886) 268; Fl. Coch. 3 (1892) t. 235A. 253; BRANDIS J. Linn. Soc. Bot. 31 (1895) 42; HEIM Bot. Tidsskr. 25, 1 (1902) 44; GUERIN in LECOMTE Fl. Gén. I-C. 1 (1912) 367; TARDIEU in *ibid.* Suppl. 1 (1943) 343; CRAIB Fl. Siam. Enum. 1 (1925) 139; LECOMTE Bois Indochine (1926) 115.—*Dipterocarpus parallelus*, *Dryobalanops hallii* KORTH. ex BURCK Ann. Jard. Bot. Btzig 6 (1887) 220, 243.—*A. robusta* PIERRE Fl. Coch. 3 (1894) t. 236; BRANDIS J. Linn. Soc. Bot. 31 (1895) 42; GUERIN in LECOMTE Fl. Gén. I-C. 1 (1912) 368; TARDIEU in *ibid.* Suppl. 1 (1943) 343; CRAIB Fl. Siam. Enum. 1 (1925) 140; SYM. Gard. Bull. S. S. 8 (1934) 11.—*A. glabra* (non KURZ) PIERRE Fl. Coch. 3 (1892) 235B; GUERIN in LECOMTE Fl. Gén. I-C. (1912) 368; TARDIEU *ibid.* Suppl. 1 (1943) 343.—*A. marginatoides* HEIM Bot. Tidsskr. 25 (1902) 44; GUERIN in LECOMTE Fl. Gén. I-C. 1 (1912) 369; TARDIEU in *ibid.* Suppl. 1 (1943) 344; CRAIB Fl. Siam. Enum. 1 (1925) 139.—*A. mindanensis* FOXW. Philip. J. Sc. 13 (1918) Bot. 181; *ibid.* 67 (1938) Bot. 266; MERR. En. Philip. 3 (1923) 92.—*Anisoptera sp. A.* SYM. Mal. For. Rec. 16 (1940) 209.

Symington has already questioned the distinctness of not only *A. cochinchensis* PIERRE of Indochina from *A. costata*, which he correct united, but also *A. oblonga* DYER of Burma. Thailand and northern Malaya (Isosyntypes: Griffith 719, 920, 939, Mergui (K)) which he kept separate on account of its larger more sparsely pubescent leaves; according to the original description *A. cochinchinensis* has 30–35 stamens, but I have not found this to be the case. He also tentatively recognised *Anisoptera sp. A.*, with relatively small few-nerved leaves, from N.W. Malaya. I have examined the many collections under these names at Kepong, Singapore, Kew and elsewhere and am unable to find a single character to consistently distinguish them, nor can I distinguish *A. robusta* PIERRE of Laos and Vietnam (Isosyntypes PIERRE 1549-1571 (P, K)), with densely pilose vegetative parts, or *A. mindanensis* FOXW. (known from a single flowering collection: lectotype: FB 21899, Naga Naga, Zamboanga, Mindanao (K)) which is uniquely entirely epilose on twigs and leaves but does not otherwise differ.

As now understood, therefore, *A. costata* is distinguished by its 25 stamens and generally grey-brown pubescent leaf with generally at least 15 pairs of nerves. It occurs from Mindanao (one definite record) through Borneo, Java, Sumatra and Malaya to Chittagong, Burma, Thailand and Indochina. In Mindanao it is epilose but for petals and ovary; in Borneo it has relatively small chartaceous sparsely grey-brown pubescent leaves with 15–20 pairs of nerves; in Java, Sumatra and sometimes Malaya the leaves are similar but somewhat larger, with to 22 pairs of nerves; In Malaya the species becomes more variable however, usually being relatively large-leaved, with a rather dense, often golden tomentum; in the north-west a small golden tomentose leaved form prevails with as few as 8 pairs of nerves. In the Indochinese region the species varies much in leaf size and tomentum, and in more seasonal areas becomes shortly deciduous; no clear geographical differentiation is discernable, though variation is greatest in southern Indochina. In summary, variation appears on the whole continuous as in a panmictic population, with geographically localised forms appearing in the less seasonal areas. No forms appear distinct enough to merit taxonomic status. There is the possibility of hybridisation with *A. curtisii* in N.W. Malaya, and with *A. megistocarpa* in Johor and Singapore (large-leaved golden tomentose forms).

Van Slooten (1952) recorded *A. costata* from Celebes and the Moluccas on the basis of sterile material. It is indistinguishable from *A. thurifera* (BLCO) BL. when sterile; for phytogeographical reasons, until flowers are collected, I would prefer to tentatively associate these numbers with the latter.

Anisoptera thurifera (BLCO) BL. Mus. Bot. 2 (1852) 42; WALP. Ann. 4 (1857) 336; DC. Prodr. 16, 2 (1868) 615; VIDAL synopsis (1863) t. 14 E; BRANDIS J. Linn. Soc. Bot. 31 (1895) 44; BRANDIS & GILG in E. & P. Pfl. Fam. 3, 6 (1895) 258; MERR. & ROLFE Philip. J. Sc. 3 (1908) Bot. 115; MERRITT For. Bur. Bull. Philip. 8 (1908) 48; WHITFORD Philip. J. Sc. 2, 4 (1910) Bot. 703; For. Bur. Bull. Philip. 10 (1911) 78; FOX-WORTHY Philip. J. Sc. 6 (1911) Bot. 256; *ibid.* 13 (1918) Bot. 181; *ibid.* 67 (1938) Bot. 267; MERR. Sp. Blanc. (1918) 269; En. Philip. 33 (1923) 92; REYES, Philip. J. Sc. 22 (1923) 323; SLOOT. Bull. Jard. Bot. Btzig 3, 8 (1926) 4; SYM. Gard. Bull. S. S. 8 (1934) pl. 4c. — *Mocanera thurifera* BLCO Fl. Philip. ed. 1 (1937) 446. — *Dipterocarpus thurifer* BLCO Fl. Filip. ed. 2 (1845) 310; *ibid.* ed. 3, 2 (1878) 212; D. C. Prodr. 16, 2 (1858) 614.

This Philippine species, with its oblanceolate leaf, has been much collected; when sterile it is sometimes indistinguishable from the usually broader leaved *A. costata* though the acumen is generally bent downwards (or twisted over in pressed specimens). It differs markedly, however, in possessing 45–47 stamens; the tomentum is generally sparse and short, even absent, on vegetative parts. In seasonal north-eastern Luzon and as far south as Real, Quezon a form occurs, apparently mixed with the typical form, with a more or less distinctly chocolate-brown lepidote leaf undersurface and young parts. This was distinguished as *A. brunnea* FOXW. (FB 11292, Camalamugan, Cagayan Prov. (K)), but as the scale colour varies greatly and apparently continuously, from chocolate to the typical greyish colour of *A. thurifera*, I do not recognise this taxon, even at infraspecific level. *A. aurea* FOXW., a species of aseasional central east Luzon and Polillo nearby, differs not only in the distinctive golden undersurface but in having 35–38 stamens, a distinctive pale cream-brown scolloped bark with rather persistent flakes peeling away from above, and very narrow laminae in the inner bark giving it a granular appearance in transverse section. *A. thurifera*, with which it grows on ridges in Mixed Dipterocarp forest, has a distinctly different less persistently flaky grey-brown bark surface. The two species are clearly distinct.

The position is complicated, however, by the fact that no reliable distinguishing characteristics exist between *A. thurifera* and the very variable New Guinea species *A. polyandra* BL. (Type: Zippelius s.n. sub 902, 146–52, 59–64; New Guinea (L)) which must therefore be reduced to it. Though typically with an obovate leaf otherwise similar to that of *A. thurifera*, the leaves can be more or less coriaceous, glabrous and with as few as 10 pairs of nerves, as in the type of *A. forbesii* BRANDIS (Holotype: Forbes 373, Sogeri region, New Guinea (K)), already reduced to *A. polyandra* by VAN SLOOTEN (1926); they can also be relatively large and chartaceous, with as many as 17 pairs of nerves as in *A. kostermansiana* DILMY (Type: NGF 7355, Morobe dist. New Guinea (BO, K)); specimens of this kind sometimes have as many as 57 stamens. A continuous range from 37 to 57 stamens occurs among New Guinea specimens as a whole, however, and I am unable to maintain *A. kostermansiana* as a separate taxon. It should be noted also that the New Guinea range in stamen number obscures the differentiation between *A. thurifera* and *A. aurea*. I still maintain the latter separately owing to its distinctive leaf and bark, and because, though some New Guinea specimens are faintly golden lepidote, they never approach the vivid colour of *A. aurea*. It is interesting that other New Guinea collections, from West Irian, are more or less dark chocolate-brown lepidote as in the Philippines form *A. brunnea*.

A. thurifera is now seen to be the eastern analogue of *A. costata* with a distribution, if sterile collections from Celebes and the Moluccas are included here, from northern Luzon throughout the Philippines to Celebes, Moluccas and New Guinea. In the Philippines geographically defined variation occurs and a separate species, probably of common origin, has evolved within the aseasional parts of its

range. In New Guinea local variation is great and collections presently inadequate to define geographical forms. It is interesting that the species is known in both the Philippines and New Guinea to be the only dipterocarp which readily reinvades cultivated land.

I recognise the Philippine and New Guinea populations as geographical subspecies:

KEY TO THE SUBSPECIES.

1. Leaves oblanceolate to lanceolate, prominently acuminate, stamens 45–47 Ssp. *thurifera*.
2. Leaves obovate; Stamens 37–57 Ssp. *polyandra*.

Ssp. *thurifera*.—*Mocanera mayapis* BLCO Fl. Filip. ed. 1 (1837) 449. — *Dipterocarpus mayapis* BLCO Fl. Filip. ed. 2 (1845) 313; D.C. Prodr. 16, 2, (1868) 610; DYER J. Bot. 12 (1874) 108; BRANDIS J. Linn. Soc. Bot. 31 (1895) 40; MERR. Publ. Gov. Lab. Philip. 27 (1905) 21.—*Antherotriche lanceolata* TURCZ. Bull. Soc. (Imp.) Nat. Mosc. 2 (1846) 505; WALP. Ann. 1 (1848) 113.—*Anisoptera lanceolata* WALP. Ann. 1 (1848) 113; DC. Prodr. 16, 2 (1868) 616; VIDAL Phan. Cuming. (1885) 97; F.-VILL. Nov. App. (1880) 20; BRANDIS & GILG in E. & P. Pfl. Fam. ed. 1, 3, 6 (1895) 263; GILG in E. & P. Pfl. Fam. ed. 2, 21 (1925) 259.—*Shorea mayapis* BL. Mus. Bot. 2 (1852) 33; DC. Prodr. 16, 2 (1868) 632.—*Anisoptera oblonga* (non DYER) F.-VILL. Nov. App. (1880) 20; VIDAL Rev. Pl. Vasc. Filip. (1886) 60.—*D. turbinatus* (non GAERTN. f.) F.-VILL. Nov. App. (1880) 20.—*Anisoptera vidaliana* BRANDIS J. Linn. Soc. Bot. 31 (1895) 44; PERK. Fragm. Fl. Philip. (1904) 23; MERR. Philip. J. Sc. 1 (1906) Suppl. 97.—*Anisoptera tomentosa* BRANDIS J. Linn. Soc. Bot. 31 (1895) 45.—*Anisoptera calophylla* PERK. Fragm. Fl. Philip. (1904) 22.—*Anisoptera brunnea* FOXW. Philip. J. Sc. 6 (1911) Bot. 254; *ibid.* 13 (1918) Bot. 181; *ibid.* 67 (1938) 270; MERR. En. Philip. 3 (1923) 92.

Tall or medium sized buttressed tree. Twigs, leaf buds, stipules, petioles and leaves beneath $\pm$ densely persistently grey-green or pale to chocolate-brown lepidote; panicles, flower calyx and ovary densely grey-brown puberulent; panicle and calyx becoming sparsely so or glabrescent in fruit. Twig *c.* 3 mm ϕ apically, terete, rugulose, pale brown. Leaf bud to 4 by 2 mm, lanceolate; stipules to 8 mm long, linear. Leaves 6–15 by 2.5–6.5 cm, thinly coriaceous, elliptic to lanceolate or obovate-oblanceolate, $\pm$ coriaceous; base broadly cuneate or obtuse; acumen to 1.3 cm long, slender, downcurved and twisting over on pressing; nerves (12–) 14–18 (–20) pairs, slender but distinctly elevated beneath, less so above (as also the reticulate tertiary nerves), arched, at 55–80°, depressed above; petiole 1.7–3.5 cm long, slender. Panicles to 20 cm long, terminal or subterminal axillary, lax, pendent; singly branched, branchlets bearing to 11 flowers. Flower buds to 9 by 3 mm, lanceolate. Sepals narrowly deltoid; 2 longer subacute, 3 shorter, prominently acuminate. Stamens 45–47, subequal; filaments short, slender, filiform; anthers narrowly oblong, somewhat tapering; appendages very slender, $\pm$ twice length of anthers. Stylopodium narrowly ellipsoid-cylindrical, puberulent distally, with prominent trifid style. Fruit pedicel to 3 mm long, short. Calyx tube to 17 mm ϕ , globose; 2 longer lobes to 15 by 1.5 cm, spatulate, narrowly obtuse, *c.* 4 mm wide at base; 3 shorter lobes to 30 by 3 mm, linear. Stylopodium short, conical.

DISTR. Malesia: Philippines, commonest in the more seasonal areas.

Ssp. *polyandra* (BL.) ASHTON *stat. nov.* — *A. polyandra* BL. Mus. Bot. 2 (1852) 42; WALP. Ann. 4 (1857) 335; MIQ. Fl. Ind. Bat. 1 (1859) 501; Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 84; DC. Prodr. 16, 2 (1868) 615; SCHEFF. Ann. Jard. Bot. Btzig 1 (1876) 9; F.v. M. Descr., Not. App. 6 (1887) 97; BURCK Ann. Jard. Bot. Btzig 6 (1887) 220; BRANDIS J. Linn. Soc. Bot. 31 (1895) 45; DIELS Bot. Jahrb. 57, 4 (1922) 461; LANE-POOLE For. Res. (1925) 22, 33, 119, 167; SLOOT. Nov. Guinea 14 (1926) 222; Bull. Jard. Bot. Btzig 3, 8 (1926) 15; Reinwardtia 2 (1952) 11; WHITE & FRANCIS Proc. R. Soc. Queensl. 38 (1927) 247.—*Dipterocarpus parviflorus* ZIPP. Flora 12 (1829) 281; Alg. Konst. en. letterbode 1, 19 (1929) 296; Bijdr. Natuurk. Wetensch. 5 (1830) 178, *nomen nudum*.—*Anisoptera* sp. DYER J. Bot. 16 (1878) 99; Burck Ann. Jard. Bot. Btzig 6 (1887) 221; BRANDIS J. Linn. Soc. Bot. 31 (1895) 45; DIELS Bot. Jb. 57, 4 (1922) 461.—*A. forbesii* BRANDIS J. Linn. Soc. Bot. 31 (1895) 45; DIELS Bot. Jb. 57, 4 (1922) 491; BAKER f. J. Bot. 61 Suppl. (1923) 5.—*A. kostermansiana* DILMY Reinwardtia 3 (1956) 347; *ibid.* 5 (1960) 267,

Differing as follows: leaves 8.5–18 by 3.5–8.5 cm, elliptic to obovate, ± coriaceous; base cuneate, obtuse or cordate; apex shortly acuminate; nerves (10–) 12–14 (–17) pairs, slender but distinctly elevated on both surfaces. Stamens 37–57. Fruit pedicel to 4 x 2 mm, prominent; 2 longer calyx lobes to 9 by 1.1 cm, 2 shorter lobes to 7 by 0.6 cm.

DISTR. Malesia: New Guinea, and possibly (sterile material) Celebes, Moluccas (Morotai, Halmahera, Bacan, Obi and Aru Is.).

Vatica

Vatica umbonata (HOOK. f.) BURCK Ann. Jard. Bot. Btzig 6 (1887) 232; SLOOT. Bull. Jard. Bot. Btzig 3, 9 (1927) 132, 133; ASHTON Gard. Bull. Sing. 20 (1963) 250; Man. Dipt. Brun. (1963) 78; *ibid.* Suppl. (1968) 36; MEIJER & WOOD Sab. For. Rec. 5 (1964) 320.

Ssp. umbonata. BRANDIS J. Linn. Soc. Bot. 31 (1895) 135; BRANDIS & GILG in E. & P. Pfl. Fam. ed. 1, 3, 6 (1895) 270; MERR. En. Born. (1921) 409; RIDL. Fl. Mal. Pen 1 (1922) 249 *p.p.*; GILG in E. & P. Pfl. Fam. ed. 2, 21 (1925) 265.—*Pachynocarpus umbonatus* HOOK. f. Trans. Linn. Soc. 23 (1860) 159; MIQ. Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 85; DC. Prodr. 16, 2 (1868) 617; WALP. Ann. 7 (1868) 378.—*V. verrucosa* BURCK Ann. Jard. Bot. Btzig 6 (1887) 232; SLOOT. Bull. Jard. Bot. Btzig III, 9 (1927) 131; BROWNE For. Tr. Sarawak and Brunei (1955) 102.—*P. verrucosus* HEIM Rech. Dipt. (1892) 107; BRANDIS J. Linn. Soc. Bot. 31 (1895) 136; MERR. En. Born. (1921) 410; RIDL. Fl. Mal. Pen. 1 (1922) 249 *p.p.*—*V. blancoana* ELMER Leaf. Philip. Bot. 4 (1912) 1473; FOXW. Philip. J. Sc. 13 (1918) Bot. 196; *ibid.* 67 (1938) 326; MERR. En. Philip. 3 (1923) 102.—*V. cupularis* SLOOT. Bull. Jard. Bot. Btzig III, 9 (1927) 132; *ibid.* (1929) 20; HEYNE Nutt. Pl. ed. 2, 2 (1927) 1129; BROWNE For. Tr. Sarawak and Brunei (1955) 100.—*V. ramiflora* (non HEIM) SLOOT. Bull. Jard. Bot. Btzig 3, 9 (1927) 118. *p.p. ibid.* (1929) 205 *p.p.*—*V. stapfiana* (non SLOOT.) BROWNE For. Tr. Sarawak and Brunei (1955) 102.

HOLOTYPE: Motley s.n., Labuan (K).

Fruit to 3 cm long and ϕ , pink-brown verrucose, compressed at base; calyx united into a tube adpressed to and fused to nut, differentiated into 5, to 2.6 by 1.8 cm, oblong-elliptic, up to 5 mm, thick lobes by 5 deep longitudinal furrows; nut 3-sulcate, exposed only at apex.

DISTR. Malesia: Malaya (Pahang, Trengganu). W. and N. Borneo, Palawan.

I reduce *V. blancoana* ELMER (LECTOTYPE: Elmer 13123, Mt. Pulgar, Puerto Princesa, Palawan, K) here for the first time. Though in flower, there is no other species in the Palawan region with similar leaves.

Ssp. acrocarpa (SLOOT.) ASHTON *stat. nov.*—*V. acrocarpa* SLOOT. Bull. Bot. Gard. Btzig 3, 17 (1942) 241; MEIJER & WOOD Sab. For. Rec. 6 (1964) 320.

ISOHOLOTYPE: San 4298, Umas Umas, Sabah (K).

Nut ovoid, acute, the fruit sepals united to basal $\frac{1}{2}$ only and reflexed.

DISTR. E. Borneo.

NOTE. *V. umbonata* is frequently gregarious on riverbanks and the continuous variation found in this habitat, especially in N.E. Borneo where the two subspecies occur in the same area, and in E. Malaya where the closely related *V. stapfiana* occurs in the same habitat, suggests panmixis and hybridisation.

Vatica venulosa BL. Mus. Bot. Lugd.-Bat. 2 (1852) 32; WALP. Ann. 4 (1857) 337; MIQ. Fl. Ind. Bat. 1, 2 (1859) 502; DC. Prodr. 16, 2 (1868) 623; BURCK Ann. Jard. Bot. Btzig 6 (1887) 232; MERR. En. Born. (1921) 409; SLOOT. Bull. Jard. Bot. Btzig III, 9 (1927) 78; ASHTON Gard. Bull. Sing. 20 (1963) 251; Man. Dipt. Brun. (1964) 79, *ibid.* Suppl. (1968) 36.

Ssp. venulosa.—*V. bancana* SCHEFF. Nat. Tijd. N. I. 31 (1870) 348; *ibid.* 32 (1873) 407; BURCK Ann. Jard. Bot. Btzig 6 (1887) 229; BRANDIS J. Linn. Soc. Bot. 31 (1895) 128; BRANDIS & GILG in E. & P. Pfl. Fam. 1, 3, 6 (1894) 269; K. & V. Bijdr. (1905) 127; MOLL & JANSSENIUS Mikrogr. Holz (1906) 360; KOORD. Exk. Fl. Java. 2 (1912) 622; KOORD.-SCHUM. Syst. Verz. (1913) Dipteroc. 4; HALLIER Med. Rijksherb.

36 (1918) 4; MERR. En. Born. (1921) 408; GILG in E. & P. Pfl. Fam. ed. 2, 21 (1925) 264; HEYNE Nutt. Pl. ed. 2, 2 (1927) 1128; SLOOT. Bull. Jard. Bot. Btzg III, 9 (1927) 96; FOXW. Mal. For. Rec. 10 (1932) 263; SYM. Mal. For. Rec. 16 (1943) 217; BROWNE For. Tr. Sarawak and Brunei (1955) 99; BACKER & BAKH. f. Fl. Jav. 1 (1963) 332; MEIJER & WOOD Sab. For. Rec. 5 (1964) 305. — *V. schouteniana* SCHEFF. Nat. Tijds. N. I. 32 (1873) 408. — *Dryobalanops schefferi* HANCE J. Bot. 14 (1876) 307. — *Retinodendron bancanum* KING J. R. As. Soc. Beng. Sc. 62, 2 (1893) 129. — *Retinodendron kunstleri* KING J. R. As. Soc. Beng. Sc. 62, 2 (1893) 129; BRUHL & KING, Ann. R. Bot. Gard. Calc. 5, 2 (1896) 157. — *V. kunstleri* BRANDIS J. Linn. Soc. Bot. 31 (1895) 127; BRANDIS & GILG in E. & P. Pfl. Fam. ed. 1, 3, 6 (1895) 270; RIDL. Fl. Mal. Pen. 1 (1922) 243. — *V. schefferi* BRANDIS J. Linn. Soc. Bot. 31 (1895) 128. — *Vatica lutea* RIDL. Kew. Bull. (1926) 60.

Leaves 4–12 by 1.5–5 cm, caducously pubescent beneath; nerves 7–12 pairs; midrib persistently shortly pale pink-brown puberulent above; petiole 5–9 mm long; panicle to 3 (–6) cm long.

DISTR. Malesia: Malaya (Pahang, Perak), Sumatra (Palembang), Mentawai Is, Banka, Belitung, W. Java (Bantam), Borneo.

I reduce here *V. lutea* RIDL. based on Boden Kloss 14581 (= Iboet 275) from Pulau Siberut, Mentawai Islands (SING), which clearly represents flowering collections of this species.

Ssp. *simalurensis* (SLOOT.) *stat nov.* — *V. simalurensis* SLOOT. Bull. Bot. Btzg III, 9 (1927) 100; HEYNE Nutt. Pl. ed. 2, 2 (1927) 1131.

Leaves 9–14 (–20) by 3.5–5.5 (–8) cm, glabrous; nerves 12–15; petiole 8–14 mm long; panicle to 7 cm long.

DISTR. Malesia: P. Simalur, W. Sumatra.

SYNTYPES: Achmad 831, 1019, 1125, Simalur (BO); Achmad 1401, 1463, Dejajan, Tapah Distr. Simalur (BO).

The collections bear a close resemblance to those of *V. venulosa* and are clearly conspecific, but the large size and absence of tomentum has persuaded me to maintain them as a distinct subspecies.

Vatica chartacea sp. nov.

V. venulosa, *V. havilandii* affinis sed costis lateralibus utrinsecus plus quam 16 ramulis paniculis caduce alutaceo puberulentibus petiole glabro differt.

Medium-sized tree. Young twigs, stipules and panicles caducous buff puberulent; pedicel, ovary and parts of petals exposed in bud persistently so; parts otherwise glabrous. Twig c. 2 mm ϕ apically, much branched, pale. Buds to 3 by 2 mm, ovoid, acute; stipule to 7 by 2 mm, lanceolate, caducous. Leaves 11–25 by 3–10 cm, oblong to obovate, thinly chartaceous and wrinkling on drying; base broadly cuneate or obtuse; acumen to 1 cm long, prominent; nerves 16–20 pairs, slender but distinctly raised beneath, with shorter secondaries; tertiary nerves sinuately subscalariform, slender and elevated on both surfaces; midrib stout, terete and prominent beneath, distinctly elevated above; petiole 10–22 mm long, slender. Panicle to 5 cm long, to 3-axillary, stout. Flower buds to 6 by 2 mm, fusiform; sepals subequal, lanceolate, subacuminate; anthers small, broadly oblong, tapering to the equally long prominent stout appendages; style columnar, somewhat longer than ovary, slightly tapering, rimmed beneath the conical stigma; flowers otherwise typical. Fruit pedicel to 6 mm long, very slender. Fruit sepals to 6 by 1.5 cm, subequal, lanceolate, subacute, cordate at base, 5–7 nerved, ascending and hiding the -13 by 11 mm ellipsoid nut.

DISTR. Malesia: W. and N.E. Borneo (Bintulu, Sarawak; Beluran and Sandakan to Tawau).

HOLOTYPE: San 46208, Sapi F. R., Beluran (K).

OTHER COLLECTIONS: San 57050, Kalumpang F. R., Mostyn; San 18397, Mile 10½, S. Limau, Kalumpang road, Lahad Datu; San 29318, Mile 14, Kalumpang, Tawau road; San 61253, A. 2959, A. 1725, S. Lagsikan, Sandakan Bay; San A. 4764, Kretam, Lahad Datu; San 17654, Lungmanis F.R., Sandakan; S. 15808, Segan, F.R. Bintulu, Sarawak; b.b. 35257, Embal, b.b. 35244, Ulu Samulang, Ulu Kapuas, West Kalimantan.

ECOL. Moist low hillsides and banks of sluggish rivers; very local.

Showing the distinctive fruit of *V. venulosa* BL. and *V. havilandii* BRANDIS, this species is characterised by its large oblong-obovate leaves, many nerves and short caducous buff tomentum.

Vatica pauciflora (KORTH.) BL. Mus. Bot. 2 (1852) 31; DC. Prodr. 16, 2 (1868) 618; MIQ. Sum. (1861) 191; BURCK Ann. Jard. Bot. Btzig (1887) 226; BRANDIS J. Linn. Soc. Bot. 31 (1895) 124. — *Retinodendron pauciflorum* KORTH. Kruidk. 3 (1841) 58. — *Vateria pauciflora* WALP. Rep. 5 (1845) 126; DC. Prodr. 16, 2 (1868) 626. — *V. rassak* (non BL.) WALP. Rep. 5 (1845) 126. — *Elaeogyne sumatrana* MIQ. SUM. (1861) 460, 183; MUELL.-ARG. in DC. Prodr. 15, 1 (1866) 1257; HALL. f. Med. Rijksherb. 36 (1918) 4. — *V. zollingeriana* DC. Prodr. 16, 2 (1868) 618; BURCK Ann. Jard. Bot. Btzig (1887) 227; BRANDIS J. Linn. Soc. 31 (1895) 124; SLOOT. Bull. Jard. Bot. Btzig III, 9 (1927) 126. — *V. wallichii* DYER J. Bot. 12 (1874) 154; BURKILL & FOXW. J. Str. Br. R. As. Soc. 86 (1922) 273; CRAIB Fl. Siam. Enum. 1 (1925) 141; HEYNE Nutt. Pl. ed. 2, 2 (1927) 1132; SLOOT. Bull. Jard. Bot. Btzig III, 9 (1927) 123; FOXW. Mal. For. Rec. 10 (1932) 269; BURK. Dict. 2, 2225; SYM. Mal. For. Rec. 16 (1943) 230. — *V. lamponga* BURCK Ann. Jard. Bot. Btzig 6 (1887) 227; BRANDIS J. Linn. Soc. Bot. 31 (1895) 123; BRANDIS & GILG in E. & P. Pfl. Fam. ed. 1, 3, 6 (1895) 269; HEYNE Nutt. Pl. ed. 1, 3 (1917) 313; *ibid.* ed. 2, 2 (1927) 1131; GILG in E. & P. Pfl. Fam. ed. 2, 21 (1925) 264. — *V. forbesiana* BURCK Ann. Jard. Bot. Btzig 6 (1887) 228; BRANDIS J. Linn. Soc. Bot. 31 (1895) 124; HEYNE Nutt. Pl. ed. 2, 2 (1927) 1131. — *V. ruminata* BURCK Ann. Jard. Bot. Btzig 6 (1887) 227; HEYNE Nutt. Pl. ed. 2, 2 (1927) 1132. — *Pachynocarpus wallichii* KING J. R. As. Soc. Beng. Sc. 62, 2 (1893) 135 p.p.; BRANDIS J. Linn. Soc. Bot. 31 (1895) 136; RIDL. Fl. Mal. Pen. 1 (1922) 250 p.p.; BURK. J. Str. Br. R. As. Soc. 81 (1920) 75. — *P. ruminatus* BRANDIS J. Linn. Soc. Bot. 31 (1895) 136. — *V. ovalifolia* RIDL. J. Str. Br. R. As. Soc. 54 (1909) 26. — *V. kelsallii* RIDL. J. Str. Br. R. As. Soc. 54 (1909) 27; Fl. Mal. Pen. 1 (1922) 244. — *P. umbonatus* (non HOOK. f.) RIDL. Fl. Mal. Pen. 1 (1922) 249 p.p. — *P. ridleyanus* RIDL. Fl. Mal. Pen. 1 (1922) 250 p.p. — *V. sumatrana* SLOOT. ex HEYNE Nutt. Pl. ed. 2, 2 (1927) 1131; SLOOT. Bull. Jard. Bot. Btzig III, 9 (1927) 120; BACKER & BAKH. f. Fl. Jav. 1 (1963) 332.

Occupying the same habitat as *V. umbonata* and indistinguishable from it when sterile, the fruit calyx is nevertheless characteristic.

The type of *Retinodendron pauciflorum* KORTH. (Korthals s.n. sub. 902, 146-770, near Indrapura, Padang, S. Sumatra (L)) consists of leaves and loose buds but as *V. umbonata* is unknown from Sumatra we may safely conclude that *Vatica sumatrana* (MIQ). SLOOT., based on Teysmann 4227 and 4345 HB, Tarabangi, Lampong (L, U) in fruit is synonymous with it. The fruit characters by which VAN SLOOTEN (1927) distinguished *V. sumatrana* and *V. wallichii* DYER do not define a consistent discontinuity in variation and may in part be attributable to their degree of maturity.

Vatica soepadmoi sp. nov.

Species in sectione Vaticae fructu ovoidea verrucosa sepalis lanceolatis patentibus recurvis revolutis unguiformibus satis distinguitur.

A small tree. Twigs, leaf buds, petioles, midrib above, and panicles densely persistently pale brown scabrid puberulent, nut evenly so; nervation beneath sparsely so. Twigs c. 2 mm ϕ , ribbed at first, becoming terete. Leaf buds to 8 by 4 mm, lanceolate, acute. Leaves 7.5-12 by 3-5.5 cm, elliptic, oblong to narrowly ovate, coriaceous, somewhat bullate between the nerves; margin subrevolute; base obtuse; acumen to 1.5 cm long, slender, prominent; nerves c. 11 pairs, arched, tending to branch within the margin and form a $\pm$ indistinct looped intramarginal nerve, prominent beneath, shallowly depressed above, with short slender secondary nerves; tertiary nerves subreticulate, evident beneath, $\pm$ obscure above; midrib stoutly

prominent beneath, evident but $\pm$ channelled above; petiole 10–15 mm long, slender. Panicle to 6.5 cm long, axillary, hardly branched. Flowers unknown. Fruit pedicel to 6 mm long, prominent; calyx equal, to 18 by 10 mm, lanceolate, acute, recurved inwards and $\pm$ revolute thus resembling claws; nut ovoid, not known at maturity.

HOLOTYPE: Soepadmo S. 45, Pekanbaru, Tenajan R., Upper Riau, E. Sumatra.

Known from this collection alone, in young fruit. The leaves somewhat resemble those of *V. oblongifolia* HOOK. f. ssp. *oblongifolia* but the pale brown scabrid tomentum, ovoid verrucose nut with thick pericarp, and linear-lanceolate patent recurved and revolute claw-like sepals make this a rather distinctive species possibly most closely allied with *V. granulata* SLOOT. and *V. sarawakensis* HEIM.

Vatica rassak (KORTH.) BL. Mus. Bot. Lugd.-Bat. 2 (1852) 31; WALP. Ann. 4 (1857) 337; MIQ. Fl. Ind. Bat. 1, 2 (1859) 502; Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 85; DC. Prodr. 16, 2 (1868) 619; BURCK Ann. Jard. Bot. Btzig 6 (1887) 225; GRESH. Schets. (1900) t. 50; BRANDIS J. Linn. Soc. Bot. 31 (1895) 125; BRANDIS & GILG in E. & P. Pfl. Fam. ed. 1, 3, 6 (1895) 270; HEYNE Nutt. Pl. ed. 1, 2 (1917) 313; *ibid.* ed. 2, 2 (1927) 1130; MERR. En. Born. (1921) 409; SLOOT. Bull. Jard. Bot. Btzig III, 9 (1927) 104; *ibid.* 3, 17 (1942) 223. — *Retinodendron rassak* KORTH. Kruidk. (1841) 56. — *V. rassak* var. *subcordata* BL. Mus. Bot. Lugd.-Bat. 2 (1852) 31; MIQ. Fl. Ind. Bat. 1, 2 (1859) 502; DC. Prodr. 16, 2 (1868) 619. — *V. papuana* DYER J. Bot. 16 (1878) 100; BURCK Ann. Jard. Bot. Btzig 6 (1887) 229; BRANDIS & GILG in E. & P. Pfl. Fam. ed. 1, 3, 6 (1895) 270; K. SCHUM. & HOLLR. Fl. Kais.-Willh. Land (1889) 52; BRANDIS J. Linn. Soc. Bot. 31 (1895) 127; DIELS Bot. Jb. 57 (1922) 463; LANE-POOLE For. Res. Papua (1925) 120; SLOOT. Nova Guinea Bot. 14 (1926) 226; Bull. Jard. Bot. Btzig III, 9 (1927) 112; *ibid.* III, 17 (1942) 233; Reinwardtia 2 (1952) 63; MERR. Philip. J. Sc. 300 (1926) Bot. 411; WHITE & FRANCIS Proc. R. Soc. Queensl. 38 (1927) 247; HEYNE Nutt. Pl. ed. 2, 2 (1927) 1129; FOXWORTHY Philip. J. Sc. 67 (1938) 328; SLOOT. *apud* HOLTHUIS & LAM Blumea, 5 (1942) 214; MEIJER & WOOD Sab. For. Rec. 5 (1964) 314; ASHTON Man. Dipt. Brun. Suppl. (1968) 35. — *Vateria papuana* DYER ex HEMSLE. Bot. Chall. 1, 4 (1884-5) 123; 287, 296, *nomen nudum*; K. SCH. & HOLLR. Fl. Kais. Willh. Land (1889) 52; HEYNE Nutt. Pl. ed. 2, 2 (1927) 1129. — *Vatica moluccana* BURCK Ann. Jard. Bot. Btzig 6 (1887) 226; BRANDIS J. Linn. Soc. Bot. 31 (1895) 124; HEYNE Nutt. Pl. ed. 1, 3 (1917) 313; *ibid.* ed. 2, 2 (1927) 1129. — *R. moluccanum* HEIM Rech. Dipt. (1892) 104. — *V. schumanniana* GILG Bot. Jb. 18, 45 (1894) 38; BRANDIS J. Linn. Soc. Bot. 31 (1895) 127; K. SCHUM. & LAUT. Fl. Schutzgeb. (1901) 451; DIELS Bot. Jb. 57 (1922) 463; BRANDIS & GILG in E. & P. Pfl. Fam. ed. 1, 3, 6 (1895) 269. — *Vatica celebensis* BRANDIS J. Linn. Soc. Bot. 31 (1895) 126; SLOOT. Bull. Bot. Gard. Btzig III, 9 (1927) 77; *ibid.* III, 17 (1942) 254; Reinwardtia 2 (1952) 65. — *V. subcordata* HALL. f. Med. Rijksherb. 3, 6 (1918) 4; SLOOT. Bull. Bot. Gard. Btzig III, 17 (1942) 228. — *V. celebica* SLOOT. Bull. Bot. Gard. Btzig III, 17 (1942) 237.

Twigs, petioles, buds and stipules outside (glabrous within) very shortly evenly persistently pale buff pubescent, leaf nervation beneath sparsely so. Twig c. 3 mm ϕ , stout, crooked, ribbed, becoming rugose, flaky, pale grey-brown; stipule scars prominent, horizontal; internodes 1–3 cm long. Bud to 4 by 4 mm, ovoid-conical, subacute. Stipules to 14 by 4 mm, lorate, subacute, subpersistent. Leaves 13–32 by 5–11 cm, oblong to narrowly elliptic, thickly coriaceous; base broadly cuneate to subcordate; acumen to 1.5 cm long; nerves (10–) 16–20 pairs, prominent beneath, slightly elevated above, arched at 50°–60°, with short hardly elevated secondary nerves; tertiary nerves reticulate; midrib prominent beneath, applanate above; petiole 2–3.5 cm long, stout, not geniculate, drying pale buff pubescent. Panicle to 14 cm long, terminal or axillary, ribbed, at first shortly evenly buff pubescent, becoming pale brown flaky; irregularly branched, with many branches near base, appearing fascicled. Flower bud to 14 by 3 mm, fusiform; calyx densely shortly pale buff pubescent; flowers otherwise typical. Fruit glabrous. Pedicel to 3 mm long, stout. Calyx lobes to 12 by 7 mm, deltoid, acute, incrassate, reflexed, recurved. Nut to 5 by 3.5 cm, oblong to ovoid, irregularly pitted and furrowed deeply at the sutures, minutely verruculose and rugulose; pericarp thick, corky.

DISTR. Malesia: Borneo (E. of Rejang valley and Sampit, commonest on E. coast), Tawi-Tawi, Celebes, Moluccas (Sulu Isl. Mangoli, Morotai, Halmaheira, Bacan, Obi Is., Aru Is.), New Guinea, Sudest Is.

On river banks in Borneo, elsewhere also on hills to 400 m.; locally abundant.

The above description defines my interpretation of this variable species. The large oblong-elliptic coriaceous leaves with long petiole, and the large corky nut, are characteristic though the nut shape is very variable (in part owing to the degree of maturity on herbarium specimens). Its distribution into seasonal areas and its semigregarious ecology parallel that of other polymorphic species such as *A. costata* KORTH., *A. thurifera* (BLCO) BL. and *V. umbonata* (HOOK. f.) BURCK discussed elsewhere in this paper.

The most recent accounts of this species are those of Van Slooten who finally (1952) concluded that *V. rassak*, *V. papuana*, *V. celebensis* and *V. subcordata* were separate species. He distinguished *V. celebensis* (Holotype: Beccari s.n. Lepo-Lepo, Kandari, Celebes (K)) principally by its smooth obtuse symmetrical nut. The single ripe fruit collection available does suggest a distinct difference but not at the level of species as some fruiting collections from New Guinea and Borneo, named *V. rassak* by VAN SLOOTEN, have a similar nut shape, though they are more verrucose; more ripe fruit are required before the constancy of these characters can be confirmed; I fail to see any consistent difference between *V. papuana* (holotype: Beccari and D'Albertis s.n., Ramoi near Sorong, W. Irian, New Guinea (K)), and *V. rassak* (type: Korthals s.n., sub 900, 171-121, S. Borneo (L)). *V. subcordata* (type: Korthals s.n. sub. 902, 146-764, Dusun Distr., S. Borneo (L)), whose range coincides with the southern part of that of *V. rassak*, represents an extreme in the range of variation, with very long petiole and subcordate leaves and (not always) very large malformed fruit.

***Vatica granulata* SLOOT.** Bull. Jard. Bot. Btzg III, 9 (1927) 112; Bull. Bot. Gard. Btzg III, 17 (1941) 136; ASHTON Man. Dipt. Brun. (1964) 70; *ibid.* Suppl. (1968) 32.

Ssp. *granulata*

Leaf 10-20 by 2.7-7 cm; stipule to 6 by 4 mm, hastate, subacute, caducous. Fruit calyx lobes to 7 by 4 mm, chartaceous, deltoid, reflexed.

TYPE: HALLIER 3399, G. Amai Ambit, Ulu Kapuas, W. Borneo (BO, L).

DISTR. Borneo (Sarawak, Brunei, Ulu Kapuas and Barito).

Ssp. *sabaensis* ssp. nov. — *V. scortechinii* MEIJER (non KING) Sab. For. Rec. 5 (1964) 319.

Lamina 15-25 x 6-10 cm; stipulae -3 x 2 cm subpersistentes oblongae vel lanceolatae acutae basim versus obtusae vel subcordatae lobis calycis in fructu — 20 x 12 mm elliptici revoluti reflexi.

DISTR. N. E. Borneo (Crocker range, S. W. Sabah to Kelabit Highlands and N.E. Sarawak).

HOLOTYPE: San 16613, N. slopes of Bt. Batanga, 5 miles south of Malaman, S.W. Sabah (K).

OTHER COLL. San 17000, Kundasan, Kota Belud; San 16708, Gunong Lamaku; S. 26312, S. Belaban, Lawas, Sarawak; Nooteboom 2233, Kelabit Highlands, Ulu Limbang, Sarawak.

Mistaken in the past for the Malayan species *V. scortechinii* KING with which it shares similar subpersistent stipules. The nut of *V. scortechinii* is smooth and puberulent however.

***Vatica hullettii* (RIDL.) comb. nov.** — *Capura hullettii* RIDL. J. Str. Br. R. As. Soc. 54 (1910) 36. — *Otophora hullettii* RIDL. Fl. Mal. Pen. 1 (1922) 454; RADLK. in E. & P. Pfl. Fam. ed. 2, 98 (1932) 775. — *V. stipulata* RIDL. J. Str. Br. R. As. Soc. 82 (1907) 172; Fl. Mal. Pen. 1 (1922) 244; SLOOT. Bull. Jard Bot. Btzg III, 9 (1927) 76; FOXW. Mal. For. Rec. 10 (1932) 253; SYM. Mal. For. Rec. 16 (1943) 229.

I am grateful to Dr. P. W. Leenhouts for drawing my attention to the fact that Ridley based his *Capura hullettii*, later changed by him to *Otophora hullettii*, and his *Vatica stipulata* on the same collection: Hullett 781, April 1888 from Mount Ophir, Malacca (K).

This species is now known from elsewhere in southern Malaya on hills; it differs from the closely allied Bornean species *V. albiramis* SLOOT. principally in its large elliptic subsistent stipules and puberulent petioles and panicle.

Vatica javanica SLOOT. Bull. Jard. Bot. Btzig III, 16 (1940) 451; BACKER & BAKH. f. Fl. Jav. I (1963) 332.

HOLOTYPE: b.b. Ja 6573 (BO, isoholotypes in L, K).

Ssp. **javanica**.

Leaves 13–24 by 6–10 cm, elliptic-oblong, applanate.

DISTR. Malesia: W. Java (Preanger regencies, once collected).

Ssp. **scaphifolia** (KOSTERM.) *comb. nov.* — *V. scaphifolia* KOSTERM. Reinwardtia, 4 (1955) 2.

Leaves $\pm$ prominently boat-shaped with the lower surface concave, $\pm$ distinctly bullate between the nerves, the nerves and sometimes tertiary nerves consequently $\pm$ channelled above.

DISTR. Malesia: S.E. Borneo (Samarinda, Balikpapan).

HOLOTYPE: Kostermans 4085, S. Wain region, Balikpapan (BO; ISOHOLOTYPE in L, K).

OTHER COLL: Kostermans 4174, b.b. 34419, S. Wain region; Kostermans 6533, Loa Djanan, W. of Samarinda.

The Bornean collections of this rare species are given a distinctive appearance by their bullate concave leaves.

Vatica mangachapoi BLCO Fl. Filip. ed. 1 (1837) 401; DC. Prodr. 16, 2 (1868) 623; VIDAL Sinopsis (1883) t. 15 b; Rev. Pl. Vasc. Philip. (1886) 61; BRANDIS J. Linn. Soc. Bot. 31 (1895) 134; MERR. Publ. Govt. Lab. Philip. 27 (1905) 22; Philip. J. Sc. 1 (1906) Suppl. 98; Sp. Blanc. (1918) 272; En. Philip. 3 (1923) 101; FOXW. Philip. J. Sc. 6 (1911) Bot. 282; *ibid.* 13 (1918) 196; *ibid.* 67 (1938) 321; REYES Philip. J. Sc. 11 (1923) 320; SLOOT. Bull. Jard. Bot. Btzig III, 9 (1927) 94; BROWNE For. Tr. Sarawak and Brunei (1955) 101; ANDERSON Gard. Bull. Sing. 20 (1963) 159. 228; ASHTON Gard. Bull. Sing. 20 (1963) 253; Man. Dipt. Brun. (1964) 71; *ibid.* Suppl. (1968) 33; MEIJER & WOOD Sab. For. Rec. 5 (1964) 310.

Ssp. **mangachapoi** — *Mocanera mangachapoi* BLCO Fl. Filip. ed. 1 (1837) 540. — *V. sinensis* (non GMEL.) BLCO Fl. Filip. ed. 1 (1837) 401; *ibid.* ed. 2 (1845) 280; *ibid.* ed. 3, 2 (1878) 156; DC. Prodr. 16, 2 (1868) 236. — *V. apteranthra* BLCO Fl. Filip. ed. 2 (1845) 281; *ibid.* ed. 3, 2 (1878) 156. — *Dipterocarpus mangachapoi* BLCO Fl. Filip. ed. 2 (1845) 313; *ibid.* ed. 3 (1878) 216; DC. Prodr. 16, 2 (1868) 614. — *Shorea mangachapoi* BL. Mus. Bot. Lugd.-Bat. 2 (1852) 34; DC. Prodr. 16, 2 (1868) 632; WALP. Ann. 4 (1857) 338; F. VILL. Nov. App. (1880) 21. — *Pteranthra sinensis* BL., *P. mangachapoi* BL. Mus. Bot. Lugd.-Bat. 2 (1852) 30. — *Anisoptera mangachapoi* DC. Prodr. 16, 2 (1868) 616. — *V. scaphula* (non DYER) F. VILL. Nov. App. (1880) 21. — *V. bureavi* HEIM Bull. Soc. Linn. Paris, 2 (1891) 955; BRANDIS J. Linn. Soc. Bot. 31 (1895) 133; MERR. En. Born. (1921) 409; SLOOT. Bull. Jard. Bot. Btzig III, 9 (1927) 76. — *Synaptea bureavi* HEIM Rech. Dipt. (1892) 114. — *V. reticulata* (non DC.) KING J. R. As. Soc. Beng. Sc. 62, 2 (1893) 106; BRANDIS J. Linn. Soc. Bot. 31 (1895) 131; SLOOT. Bull. Jard. Bot. Btzig III, 9 (1927) 83; FOXW. Mal. For. Rec. 10 (1932) 259 p.p.; BURK. Dict. 2 (1935) 2224. — *Cotylelobium philippinense* HEIM ex BRANDIS J. Linn. Soc. Bot. 31 (1895) 134, *nomen pro syn.* — *Synaptea reticulata* RIDL. Fl. Mal. Pen. 1 (1922) 243. — *V. whitfordii* FOXW. Philip J. Sc. 67 (1938) 322. — *V. patula* SYM. J. Mal. Br. R. As. Soc. 19, 2 (1941) 148; Mal. For. Rec. 16 (1943) 226.

Leaf 6–11 by 2.7–5 cm, elliptic, coriaceous; base cuneate; acumen to 7 mm long; panicle to 14 cm long.

Ssp. obtusifolia (ELMER) comb. nov.—*Vatica obtusifolia* ELMER Leaf. Philip. Bot. 4 (1912) 1471; FOXW. Philip. J. Sc. 13 (1918) Bot. 196; *ibid.* 67 (1938) 323; MERR. En. Philip. 3 (1923) 102.

LECTOTYPE: Elmer 12963, Mt. Pulgar, Puerto Princesa, Palawan (in flower) (K).

OTHER COLL. San 25435, Bt. Mesasam, Beluran, Sabah (K).

Leaf small, thickly coriaceous, obtuse to subacuminate; panicle not exceeding 6 cm long.

DISTR. Malesia: Palawan, E. Sabah. Rocky exposed ridges and plateaux, very local.

NOTES. *V. mangachapoi* is a species with much local variation, especially in the Philippines, and I have no hesitation in reducing *V. obtusifolia* to it as a sub-species. Forms approaching both *V. odorata* ssp. *mindanensis* and *V. pachyphylla* occur, and suggest hybridisation.

Vatica odorata (GRIFF.) SYM. J. Mal. Br. R. As. Soc. 19 (1941) 156; ASHTON Man. Dipt. Brun. (1964) 75; Gard. Bull. Sing. 22 (1967) 263.

Ssp. odorata.—*V. thorelii* PIERRE Fl. Coch. 15 (1890) t. 238; *ibid.* (1891) t. 254b; GUERIN in LECOMTE. Fl. Gen. I.-C. 1 (1912) 390; TARDIEU in *ibid.* Suppl. 1 (1943) 360.

SYNTYPES: Thorel *s.n.*, 1866–68, Stung Treng (P); Thorel *s.n.*, 1885, Uban, Mekong (P); Thorel *s.n.* 1862–66 Chu Dan Moth (P), all in Cambodia.

—*Perisandra laotica* GAGNEPAIN, Bull. Soc. Bot. Fr. (1948) 27.

HOLOTYPE: Poilane 12090, Savannakhet, Laos (P).

The synonymy of this species has already been fully discussed by SYMINGTON; further additions have later been made by myself. The additional Indochina species added here, based on flowers and young fruits (*V. thorelii*) or flowering specimens alone (*P. laotica*) are in my opinion well within the range of variation of *V. odorata*. The following new subspecies, previously considered a separate species is apparently confined to quartz sand raised beaches in Vietnam, generally near the coast, and bears a relationship to ssp. *odorata* as *V. mangachapoi* Ssp. *obtusifolia* does to ssp. *mangachapoi*.

Ssp. tonkinensis (TARDIEU) ASHTON comb. nov.—*Vatica tonkinensis* A. CHEV. ex TARDIEU Not. Syst. 10, 3 (1942) 137; in LECOMTE, Fl. Gén. I.-C. Suppl. 1 (1943) 357.

LECTOTYPE: Poilane 7301, Tourane, route de Ba Na (P).

Young parts fulvous flocculent pubescent as in ssp. *odorata*. Leaf 4–7 by 2–3 cm, small, elliptic-lanceolate, coriaceous, cuneate at base, $\pm$ obtuse at apex; nerves 5–10 pairs. Petiole 3–6 mm long, short, not geniculate. Panicle to 8 cm long, flowers and fruit as in ssp. *odorata*.

OTHER COLL. Chevalier 37587, Quong-Yen, Yen Lap Province (P); Pételot *s.n.*, Ile de la table, Si Quang Yen Prov.; Fleury 38019, Phong Du reserve., Tonkin; Barry 75, 70, 71, 72, 73, Kuet 95, Cam Ranh peninsular.

Tardieu cites (unnumbered) collections of BONNET from Tien Yen and another, 'service forestier' from Hongay, neither of which I have seen.

Key to the subspecies of V. odorata.

1. Lamina typically at least 8 by 2.7 cm; nerves at least 10 pairs; petiole at least 6 mm long. 2.
2. Petiole 6–18 mm long, not geniculate; leaf drying yellow brown Ssp. *odorata*

2. Petiole 15–20 mm long, $\pm$ geniculate; leaf drying greyish Ssp. *mindanensis*

 1. Lamina to 7 by 3 cm, drying yellow-brown; nerves at most 10 pairs; petiole at most 6 mm long, not geniculate Ssp. *tonkinensis*.

***Vatica brevipes* sp. nov.**

V. micranthae SLOOT. affinis sed lamina obovata basim versus anguste cuneata.

Small to medium sized tree. Buds, petioles and panicles densely persistently pale brown scabrid puberulent; parts of petals exposed in bud and ovary evenly so, sepals caducously evenly so; parts otherwise glabrous. Twigs c. 2 mm ϕ apically, red-brown, prominently rugose and ribbed, becoming flaky. Buds to 3 by 2 mm, ellipsoid. Leaves (4–) 5–13 by (1.5–) 2.5–5.5 cm, elliptic or obovate, thinly coriaceous; base narrowly cuneate; acumen to 6 mm long, short but slender; nerves 7–10 pairs, ascending, straight at first, arching and forming a $\pm$ incomplete intramarginal nerve, slender but prominent beneath, elevated above, with a few short secondaries; tertiary nerves distantly reticulate, clearly evident on both surfaces though more so below; petiole 5–11 mm long, short, rather stout. Panicles to 1.6 cm long, short, very slender, axillary or terminal, hardly branched; buds to 3 by 2 mm, ellipsoid; sepals narrowly deltoid, lanceolate, subacute; anthers broadly obong, tapering distally to the deltoid appendages; style broadly columnar, slightly longer than the ovary, terminating in a prominent rim beneath the deltoid style. Fruit pedicel to 6 mm long, slender; 2 longer calyx lobes to 5 by 1.4 cm, spatulate, subacute or obtuse; 3 shorter lobes to 12 by 3 mm, lanceolate, acute; nut to 8 mm ϕ , subglobose, apiculate.

DISTR. Malesia: Borneo (Sarawak: Ulu Rejang). Local, in Mixed Dipterocarp forest, to 700 m.

HOLOTYPE: S. 29633, Ulu Baleh, Kapit (K).

OTHER COLL.: S. 23943, 23991, Bt. Raya, Kapit; S. 29576, Ulu Baleh below Nanga Mengiong.

Though undoubtedly close to *V. micrantha* the obovate leaf serves at once to distinguish this species.

***Vatica perakensis* KING** J. R. As. Soc. Beng. Sc. 62, 2 (1893) 103, *p.p. emend* SYM. J. Mal. Br. R. As. Soc. Soc. 19, 2 (1941) 152; Mal. For. Rec. 16 (1943) 226; BRANDIS J. Linn. Soc. Bot. 31 (1895) 132 *p.p.*; BRUHL & KING Ann. R. Bot. Gard. Calc. 5, 2 (1896) 149 *p.p.*; SLOOT. Bull. Jard. Bot. Btzig III, 9 (1927) 86 *p.p.*, FOXW. Mal. For. Rec. 10 (1932) 262 *p.p.*; BURK., Dict. 2 (1935) 2224. — *Synaptea perakensis* RIDL. Fl. Mal. Pen. 1 (1922) 242. *p.p.* — *V. songa* SLOOT. Bull. Jard. Bot. Btzig III, 9 (1927) 93; HEYNE, Nutt. Pl. ed. 2, 2 (1927) 1131.

Symington (1941) has critically reviewed the taxonomy and nomenclature of this species in Malaya. I unite here *V. songa* SLOOT. (Syntypes: Theunissen 4, 4a (= b.b. 233, 234) P. Moesala, W. Sumatra (BO)) for the first time; it bears no distinct difference and similarly occurs on coastal hills in Mixed Dipterocarp forest, in West Sumatra.

***Vatica pentandra* sp. nov.**

Vaticis alteris stamina 5 foliae minutae facile distinguitur.

Twigs, petioles and panicles persistently shortly scabrid fulvous pubescent, calyx outside $\pm$ caducously so, parts of petals exposed in bud and ovary persistently evenly buff puberulent. Twigs c. 2 mm ϕ apically, ribbed, much branched, ascending. Leaf buds minute. Leaves 18–45 by 9–20 mm, elliptic, thinly coriaceous, with subrevolute margins, obtuse to broadly cuneate base and $\pm$ deeply retuse apex; nerves 4–5 pairs, ascending at c. 45°, slender, hardly elevated on either

surface though more so below; petiole 4–11 mm long, slender, hardly geniculate. Panicle to 4 cm long, slender, singly branched; branchlets bearing to 3 flowers. Flower buds to 9 by 3 mm; stamens 5, in a single whorl, flowers otherwise typical. Fruit unknown.

HOLOTYPE: Kostermans 10277, Belajan R., near Tabong, C. Kutei, E. Borneo (L).

Known from a single collection. The only *Vatica* with but 5 stamens; the leaves are among the smallest and most distinctive in the genus. Without fruit it is not yet possible to assign this species to a section though it has the general appearance of section Sunapteae.

***Vatica cauliflora* sp. nov.**

V. sarawakensis HEIM, *V. scortechinii* KING, *V. granulata* SLOOT. putate affinis sed costis lateralibus supra depressis acumine caudata petiolo gracili differt.

Twigs, petioles and panicles persistently scabrid fulvous pubescent; midrib beneath caducously so; calyx outside, parts of petals exposed in bud and ovary persistently evenly buff puberulent. Twigs c. 3 mm ϕ apically, stout, ribbed; leaf buds minute. Leaves 7–22 by 2.5–8 cm, oblanceolate, coriaceous, with subrevolute margins, obtuse to subcordate base and $\pm$ prominent subcaudate acumen; nerves c. 12 pairs, prominent beneath, evident but depressed above as also the many secondaries; tertiaries reticulate, barely elevated though evident on both surfaces; midrib prominent beneath, less so above; petiole 10–18 mm long, c. 2 mm ϕ , relatively slender. Panicles to 6 cm long, 1-axillary, doubly branched, many flowered. Flower buds to 7 by 2 mm, lanceolate, otherwise typical. Fruit unknown.

DISTR. Malesia: Ulu Kapuas, W. Borneo. Locally frequent along river banks.

HOLOTYPE: b.b. 35234, S. Inai, Ulu Kapuas, W. Kalimantan (L).

OTHER COLL.: b.b. 35262, N. Lao, Ulu Kapuas; b.b. 35245, 35246, Ulu Semulang, Kapuas.

Possibly allied to *V. sarawakensis*, *V. scortechinii* and *V. granulata*; it is distinguished by the depressed nerves above, caudate acumen and slender petiole.

Dryobalanops

***D. rappa*. BECC.**

SFN 32194, a flowering collection from swamps in S. E. Johor, Malaya, differs from *D. oblongifolius* DYER, with which it was identified, in having more coriaceous leaves and rufous flocculent pubescent innovations and inflorescence, in this resembling *D. rappa* which is otherwise unknown outside Borneo. Fruits are required to confirm this record.

Dryobalanops oblongifolia DYER — J. Bot. 12 (1874) 100; BURCK Ann. Jard. Bot. Btzg 6 (1887) 224; BRANDIS J. Linn. Soc. Bot. 31 (1895) 51; BRANDIS & GILG in E. & P. Pfl. Fam. ed. 1, 3, 6 (1895) 259; BECCARI For. Born. (1902) 550, 572; MERR. En. Born. (1921) 401; BURKILL J. Str. Br. R. As. Soc. 86 (1922) 291; DEN BERGER & ENDERT Med. Proefst. Boschw. 11 (1925) 104; GILG in ENGLER Pfl. Fam. ed. 2, 21 (1925) 255; THORENAAR Med. Proefst. Boschw. 16 (1926) 110; FOXW. J. Mal. Br. R. As. Soc. 5 (1927) 340; Mal. For. Rec. 1 (1921) 76; *ibid.* 3 (1927) 49; *ibid.* 8 (1930) 17; *ibid.* 10 (1932) 110; HEYNE Nutt. Pl. N. I. ed. 2, 2, (1927) 1105; SLOOT. Bull. Jard. Bot. Btzg III, 12 (1932) 22; BURK. Dict. 1 (1935) 867; CORNER Wayside Trees (1940) 212; SYM. Mal. For. Rec. 16 (1943) 196; WYATT-SMITH Mal. For. 18 (1955) 153 *p.p.*; BROWNE For Tr. Sarawak and Brunei (1955) 116; ASHTON Man. Dipt. Brun. Suppl. (1968) 23.

HOLOTYPE: Beccari 2533, G. Matang, Sarawak (K).

Ssp. oblongifolia — *Baillonodendron malayanum* HEIM Bull. Soc. Linn. Paris, 2 (1891) 867; Rech. Dip. (1892) 38. — *D. abnormis* SLOOT. Bull. Jard. Btzg III, 16 (1940) 449; ASHTON Bard. Bull. Sing. 22 (1967) 262.

Leaf 6–20 by 4.5–5 (6–6.5) cm; fruit calyx tube to 15 mm deep and ϕ , massive, bordered by 5, to 5 by 7 mm, deltoid acute incrassate frequently reflexed calyx lobes; nut ellipsoid to obovoid, prominently lenticellate.

DISTR. Malesia: Borneo (Kapuas hinterland, Sarawak W. of Kemana). Local on hillsides below 600 m.

Ssp. occidentalis ssp. nov. — *D. beccariana* RIDL. Fl. Mal. Pen. I (1922) 211. — *D. ovalifolia* BURKILL Guide Bot. Gard. Sing. (1928) 22.

Lamina 6–11 $\times$ 2–4.5 cm; tubus calycis in fructu -8 mm longus campanulatus margine obscure 5-lobati; nux late ellipsoidea striata lissa haud lenticellata.

DISTR. Malesia: Malaya (E. coast, rare from Perak northwards in W.); E. Sumatra (Bengkalis, Riouw, Djambi, Palembang). By streams and in fresh water swamps, locally abundant; occasionally on hillsides.

HOLOTYPE: Kep 5452, Temerloh, Pahang (KEP).

When discussing earlier the taxonomy of *D. oblongifolia* (1967) I concluded that the Bornean, and Malayan and Sumatran, populations did not deserve separate taxonomic status; inspection of further material has convinced me otherwise.

Parashorea

Parashorea stellata KURZ J. R. As. Soc. Beng. Sc. 39, 2 (1870) 66; Fl. Burm. 1 (1877) 117; PIERRE Fl. Coch. 4 (1889) 224; BRANDIS & GILG in E. & P. Pfl. Fam. ed. 1, 3, 6 (1895) 267; BRANDIS J. Linn. Soc. Bot. 31 (1895) 104; Indian Trees (1906) 70; GUERIN in LECOMTE Fl. Gen. I-C. 1 (1910) 388; TARDIEU in *ibid.* Suppl. 1 (1943) 354; RIDL. Agr. Bull. S.S. & F. M. S. 6 (1907) 170; Fl. Mal. Pen. 1 (1922) 83; BAKER f. J. Bot. 62 Suppl. (1924) 11; CRAIB Fl. Siam. Enum. 1 (1925) 144; HEYNE Nutt. Pl. ed. 1, 3 (1917) 310; *ibid.* ed. 2, 2 (1927) 1126; LECOMTE Bois de l'Indochine (1926) 113; SLOOT. Bull. Jard. Bot. Btzg III, 8 (1927) 373 p.p.; BURK. Dict. 1 (1935) 1664. — *Shorea stellata* DYER Fl. Br. Ind. 1 (1874) 304; KING J. R. As. Soc. Beng. Sc. 62, 2 (1893) 120.

HOLOTYPE: Brandis s.n., Martaban (BM).

— *P. lucida* (non KURZ) SLOOT. Bull. Jard. Bot. Btzg III, 8 (1927) 373 p.p.; SYM. Mal. For. Rec. 16 (1943) 102. — *S. cinerea* FISCHER Kew Bull. (1926) 460.

HOLOTYPE: Parkinson 1681, Thebyu Chaung, S. Tennasserim, Burma (K).

— *P. poilanei* TARDIEU Not. Syst. 10, 3 (1942) 136; in LECOMTE Fl. Gén. I-C. Suppl. 1 (1943) 354.

HOLOTYPE: Poilane 6612, Massif de la Mère et de l'Enfant, Vietnam.

The type of *Shorea cinerea* FISCHER is a typical flowering collection of *P. stellata*; nor am I able to distinguish TARDIEU's species from the present one, the distinguishing characters enumerated by her (non-reflexed young fruit sepals, glabrous stamens, linear stipules, shortly pubescent ovary) being insufficient by themselves for specific delimitation in this genus.

Van Slooten (1927) confused this species with *P. lucida* (MIQ.) KURZ. Symington (1943) united the two under the name of *P. lucida*. I do not consider this justifiable, the two species being distinguishable as follows:

P. stellata

Leaves 6–16 by 2.3–8 cm, drying as dark beneath as above (mature trees); plication obscure; nerves distinct, arched, elevated but slender and not prominent beneath; tertiary nerves dense, obscure; petiole (10–) 12–30 mm long, slender.

DISTR. Southern Burma, Thailand, Indochina and Malaya (Trengganu and Perak northwards). Frequent in lowland and hill evergreen dipterocarp forests in seasonal areas, especially in valleys, to 650 m.

Parashorea lucida (MIQ.) KURZ J. R. As. Soc. Beng. Sc. 39, 2 (1870) 66; BURCK Ann. Jard. Bot. Btzig 6 (1887) 221; BRANDIS J. Linn. Soc. Bot. 31 (1895) 104; HEYNE Nutt. Pl. ed. 1, 3 (1919) 310; *ibid.* ed. 2, 2 (1927) 1126; SLOOT. Bull. Jard. Bot. Btzig III, 8 (1927) 373 p.p.; ASHTON Man. Dipt. Brun. Suppl. (1968) 38 in nota sub *P. smythiesii*. — *Shorea subpeltata* MIQ. Sum. (1862) 488; 191; DC. Prodr. 16, 2 (1868) 632; WALP. Ann. 7 (1868) 370; BURCK Ann. Jard. Bot. Btzig 6 (1887) 219; BRANDIS J. Linn. Soc. Bot. 31 (1895) 103. — *P. stellata* (non KURZ) SLOOT. Bull. Jard. Bot. Btzig III, 8 (1927) 373 p.p.

Leaves 6–14 by 2.2–6.5 cm, $\pm$ silvery lepidote beneath; plication subpersistent; nerves dense, hardly arched, prominent beneath; tertiary nerves densely scalariform, very slender but distinctly raised beneath; petiole 10–20 mm long, relatively stout.

DISTR. Malesia: Sumatra (Central E. & W. of Barisan Range), Borneo (C. Kalimantan, C. and N. E. Sarawak). Mixed Dipterocarp forest on hills, to 700 m.

Van Slooten has already discussed the synonymy of *S. peltata* MIQ.

Neobalanocarpus nom. nov.

Neobalanocarpus heimii (KING) comb. nov. — *Balanocarpus heimii* KING J. R. As. Soc. Beng. 62, 2 (1893) 133; BRANDIS J. Linn. Soc. Bot. 31 (1895) 110; BURN MURDOCH Agr. Bull. S. S. & F. M. S. 7 (1908) 386; Trees and Timbers (1911) 3; BURK. J. Str. Br. R. As. Soc. 81 (1920) 3; J. Mal. Br. R. As. Soc. 1 (1923) 218; Dict. 1 (1935) 204; RIDL. Fl. Mal. Pen. 1 (1922) 247; HEYNE Nutt. Pl. ed. 2, 2 (1927) 1128; FOXW. Mal. For. Rec. 1 (1921) 64; *ibid.* 3 (1927) 53; *ibid.* 8 (1930) 10; *ibid.* 10 (1932) 149; J. Mal. Br. R. As. Soc. 5 (1927) 399; STRUGNELL J. Mal. Br. R. As. Soc. 9 (1931) 24; SYM. Gard. Bull. S. S. 8 (1934) 27; Mal. For. Rec. 16 (1943) 147; CORNER Wayside Trees, 1 (1940) 210. — *B. wrayi* KING J. R. As. Soc. Beng. Sc. 62, 2 (1893) 134. — *B. acuminatus* (non BRANDIS) HEIM Ass. Franc. Adv. Sc. Besancon, 1893 (1894) 560. — *Pierrea penangiana* HELM ex BRANDIS J. Linn. Soc. Bot. 31 (1895) 110 *nomen in syn.*

SYNTYPES: Kunstler 3718 (K), Wray 813, Perak (K).

Large tree with tall stout buttresses. Leaves penninerved, unequal-based, with scalariform tertiary nerves. Inflorescence paniculate. Flowers medium-sized, secund; stamens 15, glabrous, with slender tapering filaments and linear-oblong anthers bearing rudimentary appendages; ovary ovoid, with long slender style. Fruit sepals short, subequal; pericarp splitting into 3 equal valves at germination; cotyledons very unequal; first 4–5 seedling leaves in a whorl.

The possession of short equal fruit sepals, in the presence of a unique androecium structure, deprives this single species from the sole character by which it could be allotted to the genera *Shorea* or *Hopea*, underlining the close affinity between these genera. The general appearance of tree and foliage and especially the inflorescence, fruit embryo and mode of germination, suggests that this unsatisfactory genus bears affinity with *Hopea*, sect. subsect *Hopeae*; the linear anthers are somewhat approached by those of *H. plagata* (BLCO) Vidal of the Philippines though there the appendage is acicular and prominent. Nevertheless the hardly contorted corolla of broad petals is distinctive and it remains too isolated to be reduced convincingly to *Hopea*. The king of the Malayan forests must therefore retain its separate status. *Balanocarpus* it certainly is not, however, that genus having already rightly been reduced to *Hopea* by Bole (Kew Bull. 1951 (1951) 146). A new generic name is therefore necessary.

Hopea

Hopea cernua T. et B. — Nat. Tijds. N. I. 29 (1867) 252; MIQ. Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 4; BURCK Ann. Jard. Bot. Btzig 6 (1887) 241; BRANDIS & GILG in E. & P. Pfl. Fam. ed. 1, 3, 6 (1895) 244; BRANDIS J. Linn. Soc. Bot. 31 (1895) 71; GILG in E. & P. Pfl. Fam. ed. 2, 21 (1925) 238; MERR. En. Born. (1921) 402; ASHTON Man. Dipt. Brun. Suppl. (1968) 49. — *Hancea cernua* PIERRE Fl. Coch. 2 (1892) sub. t. 244.

SYNTYPES: Teysmann s.n. Sibolga (sterile) (K); Binnendijk s.n. flowers, Sumatra (K).

— *H. argentea* MEIJER Act. Bot. Neerl. 12 (1963) 348; MEIJER & WOOD Sab. For. Rec. 5 (1964) 207; ASHTON Man. Dipt. Brun. Suppl. (1968) 47.

HOLOTYPE: San. 16367, Ranau (K).

Meijer's type differs substantially only in the relatively broader leaf and more prominent nerves beneath. Examination of all the collections now available from Sumatra, northern and eastern Borneo indicates that genetic and ontogenetic variation is partially paralleled with regard to the prominence of the nerves; saplings from West Sarawak, where the mature tree leaf is small and nervation slender and not prominent, closely match Sabah and E. Borneo mature tree leaves; there the leaves are of the *H. argentea* type throughout life. Some collections from W. Sarawak have up to 18 stamens but this too is not constant. I understand this species therefore to be defined by its thinly coriaceous leaf, to 9 by 7 cm, frequently but not always glaucous beneath; its dryobalanoid venation with 10–12 pairs of main nerves but prominent though distinctly shorter secondaries; and its prominent midrib above, narrowly revolute margin, absence of floral stylopodium, and fruit with prominent shorter sepals which exceed the nut and enclose it.

Hopea coriacea BURCK Ann. Jard. Bot. Btzig 6 (1887) 237; BRANDIS J. Linn. Soc. Bot. 31 (1895) 64; MERR. En. Born. (1921) 402.

TYPE: Teysmann s.n., Borneo (K).

— *H. kelantanensis* SYM. J. Mal. Br. R. As. Soc. 19 (1941) 144; Mal. For. Rec. 16 (1943) 130.

HOLOTYPE: Kep. 50533, S. Nal, Kelantan, Malaya (KEP).

— *H. garangbuaya* ASHTON Gard. Bull. Sing. 19 (1963) 256; Man. Dipt. Brun. (1964) 101; *ibid.* Suppl. (1968) 51.

HOLOTYPE: Brun. 2006a, Ulu Senuko, Labu, Brunei (K).

Burck's species, based on a single specimen, has remained a shadowy entity. Further collection of *H. kelantanensis* from as far south as Pahang on the eastern Malayan coast, and of *H. garangbuaya* from throughout Sarawak have confirmed that these are synonymous and that both must be reduced to Burck's species. Allied to *H. cernua* T. et B., *H. coriacea* is at once distinguished by its large, 11–16 by 6–10 cm, thickly coriaceous broadly ovate leaf and large flowers and fruit. It is usually, though not always, found on sandy river banks.

Hopea malibato FOXW. in ELMER Leaf. Philip. Bot. 6 (1913) 1953; Philip. J. Sc. 13 (1918) Bot. 184; *ibid.* 67 (1938) 281; MERR. En. Philip. 3 (1923) 93; GUTIERREZ Act. Manil. 4, A, 2 (1968) 39.

TYPE: Elmer 13526, Mount Urdaneta, Cabadbaran, Agusan Province, Mindanao (K).

H. pierrei (non HANCE) FOXW. Philip J. Sc. 6 (1911) Bot. 265 p.p.; *ibid.* 13 (1918) 184 p.p. — *H. foxworthyi* (non ELMER) FOXW. Philip. J. Sc. 67 (1938) 282 p.p. — *Hopea woodiana* GUTIERREZ Act. Manil. 4 A, 2 (1968) 42.

HOLOTYPE: PNH 97150 (Gutierrez et al.). Maluso, Canas, Basilan.

— *H. dalingdingan* GUTIERREZ Kalikasan 5 (1976) 92.

HOLOTYPE: PNH 116902, Siniloan, Laguna, Luzon (PNH).

This Philippine species, as indicated already in this paper, varies greatly in the size of its parts; leaves can vary between $4-9 \times 1.5-4$ cm, and from lanceolate to ovate; flowers and fruit also vary in size though the former can reach 6 by 3 mm before anthesis, large for section *Dryobalanoides*.

Variation in leaf shape and size appears to be complex and both genetic and ontogenetic. The species occupies a wide range of sites from shales and limestone to basalt, and from river banks to ridges at 700 m. This variation would merit biometrical study in the field. I have been unable to see any discontinuity in variation either in the field or herbarium and consequently unite *H. woodiana* and *H. dalingdingan*, the names created by Gutierrez for small-leaved collections formerly confused with *H. pierrei* Hance and *H. foxworthyi* Elmer; these latter species conspicuously differ in their obscure depressed midribs on the leaf above as well as other characters. I define *H. malibato* therefore by its dryobalanoid unequal-based ovate-lanceolate leaf with c. 11 pairs of slender but elevated nerves with shorter secondaries, its evident and elevated midrib above, and by the absence of a floral stylopodium, small fruit and glabrous parts except for the petals and more or less caducous puberulent innovations. It differs therefore from *H. vesquei* HEIM in that the ripe nut does not exceed 11 mm long, from *H. dryobalanoides* MIQ. in that the fruit sepals do not exceed 4 cm long (as well as in characters of the leaf midrib and petiole) and from *H. johorensis* SYM., *H. latifolia* SYM. and *H. ferruginea* PARIJS notably in its glabrous panicle.

Hopea pierrei HANCE J. Bot. 14 (1876) 308; *ibid.* 16 (1877) 329; BRANDIS & GILG in E. & P. Pfl. Fam. 1, 3, 6 (1895) 263; BRANDIS J. Linn. Soc. Bot. 31 (1895) 67 p.p.; GUERIN in LECOMTE Fl. Gén. I.-C. 1 (1910) 372; TARDIEU in *ibid.* Suppl. 1 (1943) 344; GILG in E. & P. Pfl. Fam. ed. 2, 21 (1925) 238; DAKKUS Bull. Jard. Bot. Btzig 3, Suppl. 1 (1930) 162; SYM. Gard. Bull. S. S. 9 (1938) 323; Mal. For. Rec. 16 (1943) 139; SMITINAND Thai For. Bull. 1 (1954) 19.

HOLOTYPE: Pierre 1425, Phu Quoc island, Kampot, Cambodia (BM).

— *H. micrantha* (non HOOK. f.) HANCE J. Bot. 15 (1876) 242; — *Hancea pierrei* PIERRE Fl. Coch. 3 (1892) 248. — *Hopea avellanea* HEIM Bot. Tidskr. 25 (1902) 46; SCHMIDT Bot. Tidskr. 27 (1906) 46; GUERIN in LECOMTE Fl. Gén. I.-C. 1 (1910) 375; TARDIEU in *ibid.* Suppl. 1 (1943) 376; CRAIB Fl. Siam. Enum. 1 (1925) 147; SMITINAND, Thai For. Bull. (1954) 10; Nat. Hist. Bull. Siam. Soc. 19 (1958) 63.

HOLOTYPE: Schmidt 320, Klong Munse, Koh Chang Isl. (C).

Symington (1938) has already clarified the synonymy of this species in Malaya. I add *H. avellanea* HEIM; the distinctive depressed obscure midrib above, and hour-glass shaped stylopodium, betray the identity of the type of this name, based on insubstantial characters and inadequate material.

Hopea inexpectata sp. nov.

H. griffithii KURZ affinis novellis sericeis petiolo 6-7 mm longo brevi differt.

Medium sized smooth-barked tree. Young twigs, petioles and base of peduncles caducous tawny puberulent. Twigs c. 2 mm ϕ apically, slender, much branched, somewhat ribbed, becoming blackish, smooth. Leaves 5-9 by 2.4-4.5 cm, ovate, coriaceous; margin subrevolute; base $\pm$ equal, broadly cuneate; acumen to 15 mm long, slender; nervation dryobalanoid, main nerves 8-10 pairs, slender but distinctly elevated beneath, arched, with 1 or a few shorter less distinct secondary nerves; tertiary nerves reticulate, evident beneath; midrib sharply prominent beneath, depressed and obscure above; petiole 6-7 mm long, short, slender. Flowers unknown. Panicle to 2.5 cm long, terminal or axillary to ramiflorous, slender, singly branched; bracts unknown, caducous. Fruit pedicel to 2 mm long, slender; 2 longer calyx lobes to 7 by 1.5 cm, spatulate, subacute, tapering to 2 mm broad above the 4 by 2 mm ovate saccate thickened base; shorter lobes

to 6 by 3 mm, ovate, acuminate, shorter than nut; nut to 8 by 4 mm, ovoid-acuminate, tapering to a short apiculus bearing the vestiges of the distinct stylopodium.

DISTR. Malesia: W. New Guinea (Kebur valley). Locally frequent in lowland forest.

HOLOTYPE: BW 11331, Asiti, Kebur valley, Irian Jaya (W. New Guinea) (L).

OTHER COLL: BW 6865, Anomi, Kebur valley.

This unexpected record of the first member of section *Dryobalanoides* east of Wallace's line suggests the possibility of polyphyletic origin, presumably from section *Hopeae*, which is otherwise the only section occurring in New Guinea and already shows remarkable plasticity there as in *H. celtidifolia* (q.v.). *H. inexpectata* shows a strong superficial resemblance to *H. griffithii* KURZ, but differs in its lustrous leaf undersurface, sericeous young parts and short petiole; flowers are required for critical comparison of androecium and gynoecium.

Hopea pedicellata (BRANDIS) SYM. — Gard. Bull. S. S. 9 (1938) 327; Mal. For. Rec. 16 (1943) 138; SMITINAND Thai For. Bull. 1 (1954) 10, 19; ASHTON Man. Dipt. Brun. Suppl. (1968) 54.

LECTOTYPE: Curtis 167, Penang (K).

— *H. micrantha* (non HOOK. f.) KING J. R. As. Soc. Beng. Sc. 62, 2 (1893) 124 p.p.; RIDL. Fl. Mal. Pen. 1 (1922) 237 p.p. — *H. griffithii* var. *pedicellata* BRANDIS J. Linn. Soc. Bot. 31 (1895) 69 p.p. *quoad spec. Malay.*; RIDL. Fl. Mal. Pen. 1 (1922) 238, — *H. intermedia* (non KING) BRANDIS J. Linn. Soc. Bot. 31 (1895) 67 p.p.; — *H. mengerawan* (non MIQ.) BRANDIS J. Linn. Soc. Bot. 31 (1895) 70 p.p. — *H. pierrei* (non HANCE) RIDL. Fl. Mal. Pen. 1 (1922) 238 p.p.; FOXW. Mal. For. Rec. 10 (1932) 133 p.p.; BURK. Dict. 1 (1935) 1193 p.p. — *H. siamensis* HEIM Bot. Tidsskr. 25 (1902) 46; WILLIAMS Bull. Herb. Boiss. 2, 5 (1905) 147; SCHMIDT Bot. Tidsskr. 7 (1907) 46; GUERIN in LECOMTE Fl. Gén. I.-C. 1 (1910) 376; TARDIEU in *ibid* Suppl. 1 (1943) 348; CRAIB Fl. Siam. Enum. 1 (1925) 147; SMITINAND Nat. Hist. Bull. Siam Soc. 19 (1958) 63.

HOLOTYPE: Schmidt 508 c, Klong Son, Koh Chang Isl. (C).

I have inspected the type of *H. siamensis*, consisting of fruit only, and fail to see any differences between it and *H. pedicellata*.

***Hopea rudiformis* sp. nov.**

H. nervosae KING *H. sublanceolatae* SYM. affinis sed costis lateralibus utrinsecus 11–13 lamina subtus $\pm$ glauca differt.

Medium sized tree. Twigs, leaf buds and parts of petals exposed in bud densely $\pm$ persistently pale tawny puberulent; panicles sparsely so; calyx outside and nerves and midrib beneath sparsely caducously so. Twigs c. 2 mm ϕ apically, rather straight, ribbed, becoming smooth, dark brown. Bud small, ovoid, acute; stipule fugaceous, unknown. Leaves 6.5–14 by 3.5–7.5 cm, ovate to broadly lanceolate, thinly coriaceous, minutely stellate lepidote and appearing pale and dull beneath; margin subrevolute; base broadly cuneate; acumen to 1.5 cm long, broad, tapering, downcurved and twisted over on pressing; nerves 11–13 pairs, slender but prominent beneath, $\pm$ obscurely depressed above, arched, at 55°–65°; secondary nerves few, short, hardly elevated beneath; tertiary nerves densely scalariform, obscure; petiole 8–13 mm long. Panicle to 3.5 cm long, to 2-axillary; singly branched, branchlets bearing to 3 flowers; bracts unknown, fugaceous. Flower bud to 3 by 2 mm, ovoid, small. Sepals subequal, broadly ovate, subacuminate. Stamens 15, in 3 subequal verticils; filaments compressed at base, tapering medially and filiform below the shortly oblong anthers; appendages slightly longer than anthers, short, slender. Ovary ovoid, surmounted by an indistinct tapering ciliate stylopodium and short columnar style c. $\frac{1}{2}$ length of ovary and stylopodium. Fruit pedicel to 2 mm long, short, base of ripe fruit $\pm$

impressed. 2 longer calyx lobes to 9 by 2 cm, broadly spatulate, obtuse, c. 3 mm broad above the to 6 by 5 mm ovate deeply saccate thickened base; 3 shorter lobes to 8 by 8 mm, ovate, chartaceous at margin, subacute, reaching apex of nut and adpressed to it; nut to 8 by 8 mm, ovoid, terminating in the persistently truncate stylopodium.

DISTR. Malesia: S. E. Borneo (Sandakan to Pulau Laut); Ulu Kapuas, W. Borneo. Undulating land on deep well-drained soil in lowlands; sometimes in freshwater swamps.

VERN. Selangan jangkang, emang bahau, putang leman, damar jengkar.

HOLOTYPE: Kostermans 4394, S. Wain, North of Balikpapan (L).

OTHER COLL: Indonesian Borneo: b.b. 34778, S. Kerajan, Sengkulirang; b.b. 34314, 34250, 34295, Kostermans 4549, 4549a, S. Wain; b.b. 19460, 31175, Tanah Bumba, Seblimbingan, P. Laut; Kostermans 4109, Muan region, Balikpapan; b.b. 24655, Manggar, Balikpapan; b.b. 24939, Mentawir, Balikpapan; b.b. 25151, 25152, 25150, 25155, 25154, Loa Bakoeng, E. Koetei; b.b. 25603, Sepan; b.b. 35254, Ulu Embal, Kapuas, West Borneo; Sabah: San. 30483, 29672, Ulu Kelumpang; San. 53121, Mile 17, Kelumpang road; San 18563, Ulu Kelabakan, Tawau; Kep 35226, Segaliud, Lungmanis, Sandakan.

This species appears to be derived from the widespread *H. nervosa* KING whose geographical range includes its own. It differs in the shorter broader leaf, pale beneath and with fewer nerves; it shares however the same distinctive flowers and large fruit which associates it, with *H. nervosa* and also *H. sublancoolata* SYM. of Malaya, in a distinct subgroup within subsection *Sphaecarpae*.

Hopea bracteata BURCK Ann. Jard. Bot. Btztg 6 (1887) 239; BRANDIS J. Linn. Soc. Bot. 31 (1895) 111; SYM. Gard. Bull. S.S. 10 (1939) 337; SLOOT. Reinwardtia 3 (1956) 317; ASHTON Man. Dipt. Brun. (1964) 97; *ibid.* Suppl. (1968) 48; MEIJER & WOOD Sab. For. Rec. 5 (1964) 229. — *B. bracteatus* MERR. En. Born. (1921) 407; FOXW. Mal. For. Rec. 10 (1932) 142; BURK. Dict. 1 (1935) 284.

HOLOTYPE: Teysmann 8265 H. B., W. Borneo (BO).

— *Balanocarpus curtisii* KING J. R. As. Soc. Beng. Sc. 62 (1893) 131; BRUHL & KING Ann. R. Bot. Gard. Calc. 5, 2 (1896) 158; BRANDIS J. Linn. Soc. Bot. 31 (1895) 111; BURKILL J. Str. Br. R. As. Soc. 81 (1920) 59; RIDL. Fl. Mal. Pen. 1 (1922) 246; SYM. Gard. Bull. S. S. 8 (1934) 27. — *H. minima* SYM. Gard. Bull. S. S. 10 (1939) 337; Mal. For. Rec. 16 (1943) 133.

TYPE: Curtis 1406, Penang (K).

DISTR. Malesia: Malaya (Penang, Perak), Borneo (Sarawak, Brunei, Sandakan, S. E. Borneo to Puruktjau).

ECOL. Locally abundant on ridges below 650 m.

Symington (1939), in critical notes on this species in Malaya, concluded that it differed sufficiently there, both in having shorter panicles and in unspecified leaf characters, to merit separate specific status from the Bornean *H. bracteata*; he also recognised significant differences between the Penang and mainland populations. The species has since been collected many more times, particularly in northern Borneo, and I am now unable to sustain the Malayan collections as a separate entity.

The rare *Hopea brachyptera* (FOXW.) SLOOT. of Zamboanga, Mindanao closely resembles *H. bracteata* though the leaf is somewhat larger. The ovary differs, according to Foxworthy (Philip. J. Sc. 13 (1918) 195; *ibid.* 67 (1938) 285) in being densely pubescent; I have seen neither flowers nor fruits, which may all have been lost when the Manila herbarium was destroyed in 1945.

***Hopea celtidifolia* sp. nov.**— *H. celtidifolia* KOSTERM. nomen in herb.

Hic species ab alteris propter costas laterales arcuatas conjunctas praestat.

Medium sized scaly barked buttressed tree. Young twigs, leaf buds and stipules densely $\pm$ persistently tawny puberulent, petioles caducously so. Twig c. 1 mm ϕ apically, much branched; internodes short. Buds small, ovoid, subacute; stipules small, fugaceous. Leaves 5–10 by 3–4.5 cm, elliptic to lanceolate, coriaceous, margin subrevolute; base obtuse to broadly cuneate; acumen to 8 mm long, slender; nerves 4–5 pairs, frequently all arising from the proximal $\frac{1}{2}$ of the leaf, arched and coalescing midway to the margin forming an almost unlooped intramarginal nerve continuing to the acumen, the whole venation slender but prominent beneath, distinctly elevated above; intramarginal nerve with indistinct lateral branches to the margin; tertiary nerves scalariform, evident beneath, elevated above; petiole 8–10 mm long, slender. Panicle unknown; flowers unknown. Fruit pedicel c. 2 mm long, stout; 2 longer calyx lobes to 5 by 1 cm, spatulate, obtuse, c. 2 mm broad above the to 6 by 3 mm narrowly ovate saccate thickened base; 3 shorter lobes to 5 by 4 mm, obtuse to acute, similarly saccate. Nut to 15 by 6 cm, narrowly ovoid, the stylopodium showing as a prominent medially thickened apiculus.

DISTR. New Guinea; apparently local in evergreen lowland forests.

HOLOTYPE: BW 4854, R. Digoel, near Wagi, South New Guinea (L).

OTHER COLL: BW 8533, Iwoer, E. Digoel river junction, Moejoe subdiv., S. New Guinea; BW 6430, 6441, Ninati, Moejoe river; Bemeren 4, Strickland river.

Specimens of this astonishing species in the type section, distinguished from all other dipterocarps by its nervation, were annotated at Kew by Kostermans with the appropriate name *Hopea celtidifolia*.

***Hopea dasyrrachis* SLOOT., *Hopea plagata* VIDAL and *H. gregaria* SLOOT.**

I draw attention to the fact that the following specimen from the N. E. Sarawak limestone has been tentatively identified as *H. dasyrrachis* owing to the suborbicular longer fruit sepals: S. 24037, Melinau Gorge, G. Api, Ulu Tutoh. Nevertheless, the leaves differ from *H. dasyrrachis* from Indonesian Borneo in being narrow, glabrous, usually lacking domatia and with shorter, 5–10 mm long petioles, in all these characters resembling the Philippine species *H. plagata*. *H. plagata* fruit are occasionally (but not always) nearly suborbicular too; *H. dasyrrachis* has 10 stamens and a sericeous ovary, *H. plagata* c. 35 and a glabrous ovary though one collection (Loher 12914, Luzon) possesses only 15 stamens and has a puberulent ovary as already pointed out by Gutierrez (Act. Manil. 4, A, 2 (1968) 55). It would appear that the two species are closely related.

H. gregaria SLOOT. of Celebes, which also has 15 stamens and shares suborbicular fruit sepals, but which has a glabrous gynoecium bearing a long slender stylopodium unlike the short stylopodium of the other two species, would appear related also. More flowering collections from *H. plagata* and from *H. dasyrrachis* in N. E. Borneo are urgently required to clarify these inter-relationships.

***Hopea aptera* sp. nov.**

H. ultima sp. nov., *H. novoguineensis* SLOOT., *H. scabra* sp. nov., *H. papuana* DIELS similis lobis calycis brevibus subaequalibus differt.

Small, smooth-barked, stilt-rooted tree. Twigs, petioles and panicles $\pm$ persistently greyish sericeous, outside of calyx and leaf nervation beneath caducously so, parts of petals exposed in bud densely pubescent. Twig c. 2 mm ϕ apically, becoming terete, $\pm$ rugulose. Buds minute, ovoid; stipules fugaceous,

not seen. Leaves 10.5–25 by 4–8 cm, oblong-lanceolate, coriaceous; margin sub-revolute; base obtuse or shallowly cordate; acumen to 3 cm long, prominent, slender; nerves 15–21 pairs, slender but prominent beneath, $\pm$ obscurely depressed above, arched towards the margin, at 55° – 70° , without secondaries; tertiary nerves scalariform, very slender but elevated beneath; midrib prominent beneath, elevated above; petioles 8–12 mm long. Panicle to 7 cm long, 1-axillary to ramiflorous, lax, slender; singly branched, branchlets to 1.5 cm long, bearing to 3 secund flowers. Flower buds to 5 by 3 mm, ellipsoid, rather long. Sepals subequal, suborbicular, pubescent, fimbriate, patent. Stamens 15, in 3 unequal verticels; filaments compressed and broad at base, tapering and filiform in the distal $\frac{1}{2}$; anthers small, subglobose; appendage c. $3\frac{1}{2}$ times length of anthers, very long and slender. Ovary and stylopodium narrowly hour-glass shaped, with short but distinct columnar style. Fruit pedicel very short. Calyx lobes to 8 by 6 mm, subequal, ovate, acute, saccate, $\pm$ thinly incrassate. Nut to 10 by 6 mm, ovoid, crowned by a prominent medially swollen stylopodium.

DISTR. N. W. New Guinea (Vogelkop peninsula). Locally common, primary and secondary forest below 300 m., clay soil including limestone.

HOLOTYPE: BW 7409, Aitinjoe, Vogelkop, West New Guinea (L).

OTHER COLL.: BW 7414, 7415, loc. cit.

One of the several species in New Guinea which apparently belong to sect. and subsect. *Hopeae* yet which share with subsect. *Pierreae* a large oblong leaf with more or less unequal base and narrow tapering, though not spindle-shaped, stylopodium; *H. aptera* is distinguished by its short subequal fruit sepals.

***Hopea ultima* sp. nov.**

H. scabra sp. nov., *H. papuana* DIELS affinis aed lamina basim versus subequali subcordata tomento conferto persistenti brevi ravo differt.

Medium sized unbuttressed tree with flaky bark. Twigs, petioles, panicles and calyx densely pale tawny puberulent, midrib beneath sparsely so; parts of petals exposed in bud densely pubescent. Twigs c. 2 mm ϕ apically, terete, $\pm$ rugose, pale brown, becoming smooth. Leaves 6–17 by 3–6 cm, oblong, subsericeous; base subcordate, $\pm$ equal, margin narrowly revolute; acumen to 5 mm long, stout; nerves 16–18 pairs, slender but prominent beneath, at 50° – 65° ; tertiary nerves slender, hardly elevated, scalariform; midrib slender but prominent beneath, elevated above; petiole 9–14 cm long. Panicles to 5 (–8) cm long, -3 axillary to ramiflorous or sometimes terminal, short, slender; 1–2 branched, the branchlets bearing to 6 secund flowers. Flower buds to 5 by 2 mm, ellipsoid. Sepals unequal, the outer 2 lanceolate, inner 3 ovate, erose. Stamens 15; filaments dilated at base, tapering medially; anthers subglobose; appendage $2\frac{1}{2}$ –3 times length of anthers, aristate. Ovary and stylopodium narrowly fusiform, tapering into a shorter style. Fruit unknown.

DISTR. E. New Guinea (Milne Bay area, Normanby Is.).

HOLOTYPE: Brass 25419, Waikaiuna, Normanby Island (K).

OTHER COLL.: NGF 1342, Milne Bay area, S. E. New Guinea.

Though superficially similar to *H. scabra* and *H. papuana* the less unequal subcordate leaf base and short even tawny puberulent indumentum distinguish it.

***Hopea scabra* sp. nov.**

H. novoguineensis DIELS affinis sed fructus -8 $\times$ 6 mm minori costis tertiariis subtus glabrescentibus differt.

Medium sized buttressed tree. Twigs, petioles, leaf buds and stipules $\pm$ persistently pale rufous scabrid pubescent, leaf nervation beneath and midrib above sparsely but distinctly so; calyx fugaceous puberulent outside. Twigs c.

2 mm ϕ apically, much branched, becoming terete, smooth, pale brown. Leaf buds minute, ovoid; stipules to 7 by 3 mm, lanceolate, caducous. Leaves 6.5–17 by 2.3–6.5 cm, oblong to lanceolate-falcate, coriaceous; margin subrevolute; base unequal, cordate; acumen to 1.5 cm long $\pm$ caudate, slender; nerves 15–24 pairs, slender but prominent beneath, obscurely $\pm$ shallowly depressed above, arched, at 70°–80°, with many short but distinct secondary nerves; tertiary nerves scalariform, distinctly elevated beneath; midrib slender but prominent beneath, elevated above; petiole 4–6 mm long. Panicle to 4.5 cm long, short, slender, 1-axillary; singly branched, branchlets to 13 mm long, bearing to 4 flowers; bracts to 1 mm long, deltoid, acute. Flowers buds at anthesis unknown. Very young fruit with 2 narrowly deltoid-acuminate outer sepals, 3 suborbicular fimbriate obtuse inner sepals, and ovoid ovary surmounted by a slightly narrower, equally long, prominent stylopodium and short but distinct style. Fruit pedicel short; 2 longer calyx lobes to 8 by 1.8 cm, spatulate, obtuse, 2 mm wide above the to 5 by 4 mm ovate deeply saccate thickened base; 3 shorter lobes to 8 by 6 mm, ovate, acuminate, similarly saccate. Nut to 8 by 6 mm, ovoid; stylopodium prominent, tapering.

DISTR. W. New Guinea (Hollandia Div., Madang). Clay soils on undulating land, locally frequent.

HOLOTYPE: BW 2376, Sidoarsi mountains, 200 km. west of Jayapura (Hollandia), W. New Guinea (L).

OTHER COLL.: BW 7988, Sidoarsi mountains, BW 4826; Noordwijk, Hollandia; BW 5887, 8087, Bodem R., 600 km. S. E. of Saruni, Hollandia division; BW 15, Cyclops mountain, Hollandia Division; BW 2705, 2715, Tami, Merading, Hollandia; b.b. 25089, Kostermans and Soegeng 76, 154, 125, Jayapura (Hollandia); Hoogland 4966, Kokun R. near Jaal village, Gogol R. country, Madang distr., E. New Guinea.

The smaller nut and sparser, less scabrid tomentum distinguishes this species from *H. papuana* DIELS. Sterile collections of *H. scabra* have sparsely scabrous tertiary nerves beneath whereas in the latter they are glabrous.

***Hopea ovoidea* sp. nov.**

H. semicuneata SYM. similis sed ovario ovoidea conferte pubescenti aristis antherorum brevioribus differt.

Large buttressed flaky barked tree. Leaf bud, panicle, parts of perianth exposed in bud and ovary densely persistently pale buff pubescent, parts otherwise glabrescent. Twigs c. 1 mm ϕ apically, slender, becoming terete, smooth or rugulose. Buds minute; stipule unknown, fugaceous. Leaves 9–13 by 3–6.5 cm, elliptic to narrowly ovate, chartaceous and undulate on drying; base equal, cuneate, $\pm$ shortly decurrent; acumen to 2 cm long, slender, tapering; nerves 7–8 (to 10 in young trees) pairs, slender but distinctly elevated beneath, arched, ascending at 65°–55°, without or with a few porous canaliculate domatia; tertiary nerves scalariform, $\pm$ distinctly elevated beneath; petiole 10–15 mm long, slender. Panicle to 13 mm long, erect, slender, to 2-axillary or terminal, singly branched; branchlets to 3.5 cm long, bearing to 7 second flowers; bracteoles fugaceous. Flower buds to 3 by 2 mm, ovoid; 2 outer sepals narrowly deltoid, subacute; 3 inner sepals broadly ovate, acute; stamens 15, in 3 subequal verticels; filaments compressed at base, tapering to the narrowly elliptic subacute anthers; appendages 1½–2 times length of anther, acicular, relatively stout; ovary and stylopodium ovoid, surmounted by a short glabrous columnar style c. ½ their length. Fruit unknown.

DISTR. N. E. Borneo (Sandakan to Tawau). Low hills near coast; rare.

HOLOTYPE: E'mer 21428, Elphinstone province, Tawau (K).

OTHER COLL.: San 21690, Segama road, Lahad Datu; San A 4829, Kretam; San A 2489, Matrid, Lahad Datu.

Closely resembling *H. semicuneata* SYM. when sterile, it can nevertheless be distinguished by its brown, rather than grey-brown, drying leaves and small canaliculate rather than pustular domatia which are at times absent; the pubescent ovoid ovary and rather stout short connectival appendages (slender and thrice as long as the anthers in *H. semicuneata*) define this species.

Hopea celebica BURCK Ann. Jard. Bot. Btzig 6 (1887) 237; BRANDIS, J. Linn. Soc. Bot. 31 (1895) 64; HEYNE Nutt. Pl. ed. 2, 2 (1927) 1110; SLOOT. Reinwardtia 2 (1952) 15; BACKER & BAKH. f. Fl. Jav. 1 (1963) 331.

TYPE: Teysmann 12779 H. B., Maros, S. W. Celebes (L, BO).

— *Hopea dolosa* SLOOT. Reinwardtia, 2 (1952) 18.

TYPE: Kjellberg 2065, Lampen, Malili, S. E. Celebes (BO).

The only consistent difference between Burck's and Van Slooten's species that I can confirm is the persistence of the tomentum in the former, especially on the panicle. This does appear to distinguish specimens of the S. E. from S.W. peninsulars of Celebes but, on the meagre material presently available, would hardly appear enough to merit taxonomic recognition even at infraspecific level.

Hopea iriana SLOOT. Reinwardtia 2 (1952) 28; van ROYEN Man. Forest Trees Papua New Guinea 8 (1965) 35.

TYPE: b.b. 25644, Hollandia (BO, L).

— *Hopea nabirensis* SLOOT. Reinwardtia 2 (1952) 27; van ROYEN Man. Forest Trees Papua New Guinea 8 (1965) 38.

HOLOTYPE: Kanehira and Hatusima 12544, Sennen Nabire, Geelvink Bay, W. New Guinea (BO).

The type of *H. nabirensis*, in fruit, in my opinion represents a specimen of *H. iriana* with unusually short leaves and prominent domatia, but comes within the range of variation of that species.

Hopea pachycarpa (HEIM) SYM. Gard. Bull. S. S. 8 (1934) 30; BROWNE For. Tr. Sarawak and Brunei (1955) 125; ASHTON Man. Dipt. Brun. (1964) 105; Gard. Bull. Sing. 22 (1967) 271; Man Dipt. Brun. Suppl. (1968) 54. — *Pierreia pachycarpa* HEIM Bull. Soc. Linn. Paris 2 (1891) 598; Rech. Dipt. (1892) 78; BRANDIS & GILG in E. & P. Pfl. Fam. ed. 1, 3, 6 (1895) 268; BRANDIS J. Linn. Soc. Bot. 31 (1895) 113; MERR. En. Born. (1921) 408; GILG in E. & P. Pfl. Fam. ed. 2, 21 (1925) 263.

TYPE: Beccari 3314, Sarawak (P, K).

— *Balanocarpus pubescens* RIDL. Fl. Mal. Pen. 1 (1922) 247; FOXW. Mal. For. Rec. 10 (1932) 147; SYM. Gard. Bull. S. S. 8 (1934) 28, 32; BURK. Dict. 1 (1935) 288. — *Pierreocarpus pachycarpa* RIDL. ex SYM. Gard. Bull. S. S. 8 (1934) 30 *nomen in syn.* — *H. Iaxa* SYM. Gard. Bull. S. S. 8 (1934) 33; BROWNE For. Tr. Sarawak and Brunei (1955) 125; ASHTON Man. Dipt. Brun. Suppl. (1967) 54.

— *H. resinosa* SYM. Gard. Bull. S. S. 8 (1935) 278; Mal. For. Rec. 16 (1943) 141.

HOLOTYPE: Kep 3602, Kuantan, Pahang, Malaya (KEP).

I have earlier (1967) discussed the synonyms of this species in Borneo. I now reduce here also the Malayan *H. resinosa*. Though this typically has somewhat smaller, fewer nerved leaves which are less glaucous beneath several Bornean collection from mature trees, especially from West Sarawak, fall well within its range of variation and I am unable on present evidence to define even geographical subspecies.

Hopea bilitonensis *sp. nov.*

Species in sect. *Hopeae* subsect. *Pierreae* costis lateralibus utrinsecus 6–8 remotis costis tertiariis remote subreticulatis paniculis l-axillaribus facile distinguitur.

Small smooth barked tree with stilt roots. Leaf buds and parts of petals exposed in bud densely tawny pubescent, young twigs and panicles fugaceously so, otherwise glabrous. Twigs c. 1 mm ϕ apically, slender, much branched, red-brown, terete, smooth. Leaf buds c. 1 by 1 mm, ovoid, acute; stipules unknown, fugaceous. Leaves 7.5–16 by 3.5–6 cm, ovate-lanceolate, $\pm$ chartaceous, lustrous; base obtuse to subcordate, subequal; acumens to 2 cm long, attenuate; nerves 6–8 pairs, prominent beneath, applanate above, arched at 50°–60°; tertiary nerves distantly subreticulate, slender but distinctly elevated beneath; petiole 6–8 mm long, short. Panicle to 18 cm long, slender, axillary, solitary, lax, pendent; twice branched, branchlets to 4 cm long, bearing to 6 flowers; bracts and bracteoles minute, deltoid, caducous. Flower bud to 3 by 2 mm, lanceolate. Sepals fimbriate; 2 outer deltoid, subacute; 3 inner ovate, subacute. Stamens 15, in 3 unequal verticels, shorter than style at anthesis; filaments somewhat slender, compressed at base, tapering distally and filiform beneath the small subglobose anthers; appendages c. $3\frac{1}{2}$ times as long as anthers, very long and slender, $\pm$ crisped. Ovary small, ovoid, with somewhat longer oblanceolate stylopodium and short terminal style. Fruit pedicel to 2 mm long, stout. 2 longer calyx lobes to 5 by 1.2 cm, broadly spatulate, obtuse, c. 7 mm broad above the to 7 by 4 mm subauriculate centrally thickened base; 3 shorter lobes to 9 by 6 mm, ovate, acuminate, shorter than nut. Nut to 10 by 6 mm, ovoid, prominently slender apiculate.

DISTR. Malesia: Belitung, N. W. Malaya. Locally common in lowland forest, once recorded from limestone in Perak, N.W. Malaya.

HOLOTYPE: b.b. 23087, Air Malih, Billiton (Belitung) (L).

OTHER COLL.: b.b. 20335, Air Malih; b.b. 23085, Kepayang; Teysmann 11070, Tg. Pandan; Teysmann 11068, Mangar; Van Rossum 3, 8, b.b. 20112, Herb Billiton 4, Belitung; Kep 110201, G. Gajah, Kampar, Perak, Malaya.

An interesting species, locally common on the relatively seasonal islands of Banka and Belitung and now recorded from limestone in relatively seasonal N. W. Malaya — a distribution that has apparently become disjunct since the Pleistocene. Though an isolated species on account of its leaves, solitary axillary inflorescences and small fruit the leaves nonetheless recall those of the anomalous *H. polyalthioides* SYM. of East Johor, still unknown in flower or fruit, though they differ in size and shape.

Shorea

***Shorea falcifera* DYER** ex BRANDIS J. Linn. Soc. Bot. 31 (1895) 86; BECC. For. Born. (1902) 571; MERR. En. Born. (1921) 571.

HOLOTYPE: Beccari 3046 (K).

— *Hopea linggensis* BOERL. Cat. Hort. Bog. (1901) 103.

HOLOTYPES Tree VII. C. 2, in hort. Bog. (BO).

— *S. glauca* (non KING) BROWNE For. Tr. Sarawak and Brunei (1955) 168 p.p. — *S. flava* MEIJER Act. Bot. Neerl. 12 (1963) 325; ASHTON Man. Dipt. Brun. Suppl. (1968) 69.

HOLOTYPE: S. 9480, Santubong, Sarawak (K).

There is no doubt that Meijer's and Brandis' types represent the same species, distinguished by its relatively small glaucous falcate leaf with c. 10 pairs of nerves.

***Shorea falciferoides* FOXW.** Philip. — J. Sc. 13 (1918) Bot. 189; *ibid.* 67 (1938) 296.

SSP. ***falciferoides*.**

LECTOTYPE: F. B. 25664, Masinloc, Zambales Province, Luzon (K).

— *S. Balangeran* (non BURCK) VIDAL Phan. Cuming. (1885) 97; Rev. Pl. Vasc. Filip. (1886) 61; BRANDIS J. Linn. Soc. Bot. 31 (1885) 86; FOXW. Philip. J. Sc. 4 (1909) Bot. 508; *ibid.* 6 (1911) Bot. 269; *ibid.* 13 (1916) Bot. 187; WHITFORD Bull. For. Bur. Philip. 10 (1911) 73; MERR. En. Philip. 3 (1923) 96; REYES Philip J. Sc. 22 (1923) 336; SYM. Gard. Bull. S.S. (1935) 273.

— *S. gisok* FOXW. Philip. J. Sc. 67 (1938) 294.

LECTOTYPE: F. B. 25657, Tayabas (now Quezon) Province, Luzon (K).

Large tree, Young twig, panicle, petiole, leaf bud and stipule shortly densely evenly cream pubescent. Twig c. 2–3.5 mm ϕ apically, terete or $\pm$ compressed and ribbed, stout, smooth; stipule scars c. 1.5 mm long, pale, cuneate, horizontal. Bud to 5 by 3.5 mm, globose to ovoid, subacute, slightly compressed. Stipules c. 10 by 4 mm, obtuse, fugaceous. Leaves 10–18 by 4.5–8 cm, ovate-lanceolate, thinly coriaceous, pale cream-brown lepidote beneath; base obtuse to cuneate, equal; acumen c. 8 mm long; nerves 9–14 pairs, slender, hardly elevated beneath, at c. 40°–50°; tertiary nerves slender, densely scalariform, at c. 90° to the nerves; petiole 1.5–2 cm long, bearing to 6 close second flowers; bracteoles to 3 mm long, elliptic, shortly pubescent, fugaceous. Flower bud to 5 by 2.5 mm, small, lanceolate. Calyx densely pubescent outside, glabrous within; lobes suborbicular, obtuse, subequal. Petals cream, narrowly elliptic, acute, shortly pubescent on both surfaces. Stamens 33–45; filaments glabrous, applanate at base, tapering and filiform distantly, somewhat gibbous; anthers subglobose, the two outer cells slightly larger; appendage to connective very short on inner anthers, $\pm \frac{1}{4}$ length of anthers on outer anthers, sparsely shortly setose but for a single long apical bristle. Ovary and stylopodium ovoid, densely pubescent, tapering into the short glabrous style. Fruit calyx sparsely puberulent, more densely so at the base; 3 longer lobes to 9.5 by 2.2 cm, broadly spatulate, obtuse, with c. 8 by 8 mm thickened saccate base closely adpressed to the base of the nut; 2 shorter lobes to 7 by 1 cm, subequal, broad, tapering to 5 mm broad above the saccate base. Nut c. 15 by 15 mm, broadly ovoid, shortly densely cream-buff tomentose; style remnant c. 4 mm long, tapering.

DISTR. Throughout the Philippines to Zambales and Bulacan in the moderately seasonal north-west; in Mixed Dipterocarp forest to 1000 m., more or less confined to ridge tops in the everwet areas.

Specimens in the seasonal part of Luzon, represented by F. B. 25664, usually have somewhat smaller leaves but do not otherwise differ from those of the everwet area represented by the type of *S. gisok*. This is a common pattern of variation in Philippine dipterocarps, already discussed, and here as in other species appears to be continuous.

Ssp. glaucescens (MEIJER) *stat. nov.*

— *Shorea glaucescens* MEIJER Act. Bot. Neerl. 12 (1963) 327; MEIJER & WOOD Sab. For. Rec. 5 (1964) 170; ASHTON Man. Dipt. Brun. (1964) 134; *ibid.* Suppl. (1968) 71.

HOLOTYPE: San. 15484, Sepilok F. R., Sandakan (K).

Leaves broadly ovate-falcate, chartaceous, base subequal; nerves 8–12 pairs, well spaced, raised but not prominent beneath; petiole rather stout.

DISTR. Borneo (except the west and south-west); clay rich soils in Mixed Dipterocarp forest to 600 m.

The flowers of the two subspecies, with 33–45 stamens, appear identical and the leaf differences, though rather constant, in my opinion do not constitute adequate grounds for maintaining them separately.

Shorea astylosa FOXW. — Philip. J. Sc. 13 (1918) Bot. 188; *ibid.* 67 (1938) 297; MERR. En. Philip. 3 (1923) 96. — *S. ciliata* (non KING) FOXW. Philip. J. Sc. 13 (1918) Bot. 188; *ibid.* 67 (1938) 300.

Foxworthy maintained that B. S. 18575, Biliran island and FB. 22788, Quezon Province represented a different taxon from FB. 13271 (Foxworthy and Demesa) Dumanguilis R., Zamboanga (in flower), type of *S. astylosa*. He compared them with *S. ciliata* KING of Malaya but Merrill was in disagreement. I concur with Merrill that they belong to *S. astylosa*.

This species differs from the Bornean *S. domatiosa* ASHTON, with which it is vicarious, principally in having a prominent stylopodium and c. 32, in comparison with 25–30, stamens.

Shorea laevis RIDL. Fl. Mal. Pen. 1 (1922) 232; HEYNE Nutt. Pl. ed. 1, 2 (1927) 1121; FOXW. Mal. For. Rec. 10 (1932) 179; SYM. Mal. For. Rec. 16 (1943) 18; BROWNE For. Tr. Sarawak and Brunei (1955) 169; ASHTON Gard. Bull. Sing. 20 (1963) 273; Man. Dipt. Brun. (1964) 139; *ibid.* Suppl. (1968) 73; MEIJER & WOOD, Sab. For. Rec. 5 (1964) 178. — *S. ciliata* (non KING) RIDL. Agr. Bull. Str. & F. M. S. 4 (1905) 63; FOXW. Mal. For. Rec. 1 (1921) 69; *ibid.* 3 (1927) 66; *ibid.* 8 (1930) 19; EDWARDS Mal. For. Rec. 9 (1931) 142. — *H. laevifolia* PARIJS in Fedde, Rep. 33 (1933) 244. — *S. laevifolia* ENDERT Tectona 28 (1935) 292; BROWNE For. Tr. Sarawak and Brunei (1955) 171. — *S. rogersiana* RAIZADA & SMITINAND Thai For. Bull. Bot. 1 (1954) 7.

I have already (1963) discussed the synonyms of this species. I further reduce here *S. rogersiana*, based on Rogers 350 T, Sin Yat hill, Tavoy (Dehra Dun); the principal difference indicated by the authors is in the size and ovoid shape of the buds, which would strictly place *S. rogersiana* in the type subsection rather than in subsection Barbatae with *S. laevis*. The other floral characters, however, are typical of subsection Barbatae and it is clear that the buds are of this shape because they are approaching anthesis. *S. laevis* is now known to occur therefore in peninsular Burma and Thailand.

***Shorea micans* sp. nov.**

S. asahi ASHTON proxime affinis lobis inaequalibus 3 aliformibus differt.

Medium sized tree. Panicles and nut densely greyish puberulent, fruit calyx sparsely so, other known parts glabrous. Twigs c. 1 mm ϕ apically, slender, much branched, smooth, terete. Buds minute; stipules not seen. Leaves 5–10 by 1.8–4.7 cm, ovate-lanceolate, thinly coriaceous, lustrous on both surfaces; margin narrowly subrevolute; base broadly cuneate, $\pm$ unequal; apex to 1.3 cm caudate; nerves 7–8 pairs, very slender, slightly elevated beneath, $\pm$ applanate above, at 50°–55°; tertiary nerves obscure, scalariform; midrib slender, evident and slightly elevated on both surfaces; petiole 7–12 mm long, rather short, very slender. Panicle to 7 cm long, terminal or subterminal axillary, slender, shortly branched. Flowers unknown. Fruit pedicel c. 1 mm long, slender; 3 longer calyx lobes to 5 by 1.5 cm, spatulate, obtuse, c. 4 mm broad above the to 8 by 7 mm elliptic saccate thickened base; 2 shorter lobes to 25 by 4 mm, narrowly spatulate, acute, similar at base; nut to 19 by 7 mm including the prominent slender apiculus, ovoid.

DISTR. Malesia: N. E. Borneo (Twice collected, north of Sandakan), on ultrabasic rock in lowlands.

HOLOTYPE: San 39312, Bukit Meliau, Karamuak, N. E. Sabah.

OTHER COLL.: San 24279, Telupid road, Beluran, Sabah.

Differing (in the absence of flowering collections) from *S. asahi* only in the fruit sepals.

Shorea* Section *Pentacmes* (DC.) *stat. nov.

— *Gen. Pentacme* DC. Prodr. 16, 2 (1868) 626; KING Ann. R. Bot. Gard. Calc. 5, 2 (1896) 151; BRANDIS J. Linn. Soc. Bot. 31 (1895) 72; FOXW. Mal. For. Rec. 10 (1932) 154; SYM. Mal. For. Rec. 16 (1943) 104.

TYPE SPECIES: *S. siamensis* MIQ.

Flowers large, cream, ovoid, on lax spreading racemes; petals broadly elliptic, ovate, hardly contorted, falling separately; stamens 15, in 3 verticils; filaments short, applanate, tapering; anthers linear, glabrous, with 4 pollen sacs each prolonged and tapering apically into a prominent awn at least as long as the stoutly acicular $\pm$ recurved appendage; ovary ovoid, style filiform. Stipules and bracts fugaceous, small. Leaf with scalariform tertiary nerves; midrib raised, evident, above. Bark surface flaky. Wood anatomy and properties widely divergent between S. E. Asia and Philippine species.

DISTR. 1 species in seasonal South-East Asia, 1 in the Philippines.

I have elsewhere (Gard. Bull. Sing. 20 (1963) 254–259, 261–271) elaborated Symington's (1943 and elsewhere) conclusion that fruit provide the principal characters for generic definition among Brandis' tribe Shoreae (which includes *Parashorea*, *Hopea*, *Shorea* and, formerly, *Balanocarpus* and *Pentacme*), while the characters of the flower and in particular androecium provide definitive characters for the sections of *Hopea* and *Shorea*. De Candolle raised *S. siamensis* MIQ. to generic status on account of its flowers. Its 3-winged fruit possesses no unique characters not found in *Shorea* and it is clear that two courses alone would be consistent: to reduce *Pentacme* once again to *Shorea* as a separate section or to raise the sections of *Shorea* (and presumably *Hopea* too) to generic level. I choose the former for both theoretical and utilitarian reasons; this decision has been anticipated by my earlier (Blumea 20, 2 (1972) 361) reduction of *Doona* THW. of Sri Lanka (Ceylon) to sectional status within *Shorea*.

Though the floral morphology of the two species is unique in the genus and closely similar, the bark and wood anatomy differs widely between them. The bark of *S. siamensis* is cracked and flaky, that of *S. contorta* densely V-section fissured. This is exceptional among Dipterocarpaceae and suggests that the section is polyphyletic in origin. The appearance of the two trees — crooked and deciduous in *S. siamensis*, tall straight and evergreen in *S. contorta*, reinforces this view. A detailed comparison of bark and wood anatomy would be very worthwhile.

Shorea siamensis MIQ. Ann. Mus. Bot. Lugd.-Bat. 1 (1864) 214; DC. Prodr. 16, 2 (1968) 631; WALP. Ann. 7 (1868) 379; DYER Fl. Br. Ind. 1 (1874) 304; RYAN & KERR J. Siam. Soc. 8 (1911) 7, 15, 35. — *Hopea siamensis* WALL. Cat. (1828) n. 959 *nomen nudum*. — *Pentacme siamensis* KURZ J. R. As. Soc. Beng. Sc. 39, 1 (1870) 66; Fl. Burm. 1 (1877) 119; PIERRE Fl. Coch. 3 (1892) 225–227; HEIM Rech. Dipt. (1892) 56; Bot. Tidsskr. 25 (1902) 46; BRANDIS & GILG in E. & P. Pfl. Fam. ed. 1, 3 6 (1895) 263; GUERIN in LECOMTE Fl. Gén. I.-C. 1 (1910) 385; TARDIEU in *ibid.* Suppl. 1 (1943) 352; CRAIB Fl. Siam. Enum. 1 (1925) 145; GILG in E. & P. Pfl. Fam. ed. 2, 21 (1925) 238; FOXW. Mal. For. Rec. 8 (1930) 15, 35; *ibid.* 10 (1932) 155; BURK. Dict. 2 (1935) 1960; SYM. Mal. For. Rec. 16 (1943) 105. — *Vateria siamensis* BURCK Ann. Jard. Bot. Btzg (1887) 184.

HOLOTYPE: Teysmann s.n. near Kanburi, Thailand (U).

— *Hopea suava* WALL. Cat. (1828) n. 959 *nomen nudum*; ex DC. Prodr. 16, 2 (1868) 635. — *Pentacme suavis* DC. Prodr. 16, 2 (1868) 626; BRANDIS J. Linn. Soc. Bot. 31 (1895) 72; Indian Trees (1911) 68; GAMBLE Man. Ind. Timb. (1922) 77; TROUP Silv. Ind. Trees 1 (1925) 145; CRAIB Fl. Siam. Enum. 1 (1925) 145; GILG in E. & P. Pfl. Fam. ed. 2, 21 (1925) 259; SMITINAND Thai For. Bull. 1 (1954) 9, 10, 24. — *Shorea suavis* PIERRE ex LANESSAN Pl. Util. Colon Franc. (1886) 301.

HOLOTYPE: Wallich 959, Martaban (K).

— *S. bracteata* PIERRE ex LANESSAN Pl. Util. Colon Franc. (1886) 301. — *S. mekongensis* PIERRE ex LANESSAN Pl. Util. Colon. Franc. (1886) 301. — *S. tomentosa* (non MIQ) PIERRE Fl. Coch. 3 (1892) *sub. t.* 225 in *syn.* — *Pentacme tomentosa* CRAIB Kew. Bull. (1915) 423; Fl. Siam. Enum. 1 (1925) 145.

HOLOTYPE: Kerr 3184, Me Maw, Thailand (K).

— *Pentacme malayana* KING J. R. As. Soc. Beng. Sc. 62, 2 (1893) 107; BRUHL & KING Ann. R. Bot. Gard. Calc. 5, 2 (1896) 151; RIDL. Agr. Bull. Str. & F. M. S. 1 (1901) 62; Fl. Mal. Pen. 1 (1922) 220; CRAIB Fl. Siam. Enum. 1 (1925) 145.

ISOHOLOTYPE: Curtis 2095, Langkawi (K).

Small gnarled $\pm$ deciduous tree. Leaves glabrous or one or both surfaces $\pm$ persistently pubescent; young calyx, twigs and panicle $\pm$ caducous puberulent, otherwise glabrous. Twigs 3–5 mm ϕ apically, terete, smooth; stipule scars short, pale. Bud small, ovoid, acute; stipule to 18 by 7 mm, ovate-falcate, fugaceous. Leaves 9–12 by 6–13 cm (smaller if subtending panicles), broadly ovate-oblong, chartaceous; base deeply cordate to cuneate (if subtending panicles); acumen to 1 cm long, short, broad; nerves 13–16 pairs, slender but prominent beneath, barely elevated above as also the midrib, arched, the basal pair with prominent lateral branchlets; tertiary nerves remotely scalariform, sinuate but typically prominently elevated beneath; petiole 3–5 mm long, c. 2 mm ϕ , straight. Panicle to 14 mm long, terminal or axillary, lax, peduncle stout at base; irregularly branched, branchlets to 7 cm long, bearing a few $\pm$ secund flowers. Anthesis directly following leaf fall; bud to 15 by 6 mm, large, ellipsoid; sepals narrowly ovate, prominently slender, acuminate, subequal; petals broadly elliptic, glabrous or pubescent; stamens 15, subequal; filaments lorate, slightly tapering; anther cells linear, extended apically beyond the connective into prominent tapering horns c. $\frac{1}{2}$ their length; appendages acicular, glabrous, c. $\frac{1}{2}$ length of anthers; ovary narrowly ovoid, tapering into a stoutly columnar style c. twice its length and exceeding the stamens at anthesis. Fruit pedicel to 5 by 3 mm, broadening into the receptacle; 3 longer calyx lobes to 12 by 1.3 cm, narrowly spatulate, narrowly obtuse, c. 4 mm broad above the to 8 by 7 mm elliptic saccate thickened base; 2 shorter lobes to 7 by 0.5 cm, lorate, subacute, similar at base. Nut to 20 by 12 mm, ovoid, tapering into an up to 8 mm long prominent acicular style remnant.

Varying greatly in the distribution and density of the tomentum, reduction of which is roughly correlated with increasing humidity of climate or soil; The species *P. malayana* (leaf glabrescent) and *P. tomentosa* (both surfaces of leaf tomentose) were distinguished from *P. siamensis* (= *suavis*) with tomentose leaf undersurface, but the continuous variation which exists in nature suggests merely ecotypic differentiation in panmictic populations.

Shorea contorta VIDAL Sinopsis (1883) 15; Rev. Pl. Vasc. Filip. (1886) 61; BRANDIS J. Linn. Soc. Bot. 31 (1895) 88; MERR. Philip. J. Sc. 1 (1906) Suppl. 98. — *Pentacme contorta* MERR & ROLFE Philip. J. Sc. 3 (1908) Bot. 115; MERRITT Bull. Bur. For. Philip. J. Sc. 8 (1908) 48; WHITFORD Philip. J. Sc. 4 (1910) Bot. 703; Bull. Bur. For. Philip. 10 (1911) 61; FOXW. Philip. J. Sc. 4 (1910) Bot. 511, 516; *ibid.* 6 (1911) Bot. 266; *ibid.* 13 (1918) Bot. 186; *ibid.* 67 (1938) 287; MERR. En. Philip. 3 (1923) 95; REYES Philip. J. Sc. 22 (1923) 332.

SYNTYPES: Vidal 987, Rizal Prov. Luzon (K); Vidal 2159, Tayabas (Quezon) Province, Luzon (K).

— *Pentacme paucinervis* BRANDIS J. Linn. Soc. Bot. 31 (1895) 73.

SYNTYPES: Vidal 79, 1166, 2167, Luzon (K).

— *Pentacme mindanensis* FOXW. Philip. J. Sc. 13 (1918) Bot. 185; *ibid.* 67 (1938) 289; MERR. En. Philip. 3 (1923) 95; REYES Philip. J. Sc. 22 (1923) Bot. 332.

LECTOTYPE: F. B. 21893 (Villamil) Zamboanga Prov. Mindanao (K).

Medium sized, sometimes large evergreen tree. Panicle, parts of petals exposed in bud, ovary and leaf buds densely persistently pale brown puberulent, twigs, petioles and calyx outside caducously so. Twig c. 2–3 mm ϕ apically, terete or $\pm$ ribbed; stipule scars short, descending. Leaf buds to 6 by 3 mm, lanceolate; stipules fugaceous. Leaves 9–29 by 5.5–11 cm, ovate to oblong-lanceolate, thinly coriaceous; base subequal, obtuse or rarely cordate (subpeltate in young trees); apex broadly to 1 cm long acuminate; nerves 5–9 pairs, slender but prominent beneath, distant, arched, $\pm$ applanate above as also the midrib, set at c. 45°–70°; tertiary nerves densely scalariform, slender, hardly elevated on either surface; petioles 20–33 mm long, slender. Panicles to 22 cm long (if terminal), to 14 cm long (if axillary), singly or doubly branched; branchlets to 4 cm long. Flower

buds to 7 by 4 mm, ovoid, lanceolate; sepals ovate, obtuse, the outer 3 somewhat the larger; petals broadly oblong-elliptic, acute; stamens 15, subequal; filaments short, broad, applanate; anther cells linear and as long as the stout appendage; style columnar, c. thrice length of ovary. Fruit shortly pedicellate; 3 longer calyx lobes to 12 by 3 cm, spatulate, obtuse, tapering to c. 8 mm wide at the incrassate saccate base; 2 shorter lobes to 9 by 1.5 cm, otherwise similar. Nut to 35 by 15 mm, narrowly ovoid, apiculate.

The species is widespread in the Philippines. BRANDIS' name is based on small leaved collections from the seasonal area of N. W. Luzon, Foxworthy's represents the large-leaved form which is found scattered, mainly in the west, of Mindanao. Foxworthy himself recognized the synonymy of Brandis' species yet created a further one for large leaved collections. In discussions with foresters in the Philippines I have been informed that *P. mindanensis* has larger fruit than *P. contorta*, and that it has smaller fruit; a specimen tree of *P. mindanensis* at Los Baños, Laguna, yielded specimens with large fruit one year (Barban 11982, 11983), small in another (Barban 588). It is sometimes also said that the base of the leaf is obtuse rather than acute. There seems no doubt to me that *S. contorta* is yet another widespread Philippine species whose leaf size varies greatly, increasing from seasonal to everwet habitats. It is commonest in seasonal areas, becoming scattered, even rare in the everwet forest of the east (cf. *Anisoptera thurifera*).

Shorea henryana PIERRE in LANESSAN Pl. Util. Colon. France. (1886) 302; Fl. Coch. 15 (1890) t. 229; *ibid.* 16 (1891) t. 351b; BRANDIS, J. Linn. Soc. Bot. 31 (1895) 89; GUERIN in LECOMTE, Fl. Gén. I.-C. 1 (1910) 382; TARDIEU in *ibid.* Suppl. 1 (1943) 350.

HOLOTYPE: Pierre 1593, Xuyen Kot, Baria, Dinh Province, Vietnam (P; Syntype in K).

— *S. sericeiflora* FISCHER & HUTCH. Kew Bull. 1926, 433; PARKINSON, Ind. For. Rec. (Bot) 1 (1937) 43; SYMINGTON J. Mal. Br. R. As Soc. 19, 2 (1941) 160; Mal. For. Rec. 16 (1943) 41.

HOLOTYPE: Conservator of Forests 1954, Pegu, Burma (K).

— *S. longistipulata* TARDIEU Not. Syst. 103 (1942) 132; in LECOMTE, Fl. Gén. I.-C. Suppl. 1 (1943) 349.

HOLOTYPE: Fleury, Herb. Chev. 29.994, Gia Ray forest reserve, Cochinchina (P).

Pierre's species is based on a collection with flowers, fruit and leaves apparently from an immature tree; the velutinate parts, absence of pale lepidote leaf undersurface and prominent narrow stipules give a very different appearance from the type of *S. sericeiflora*, collected from a mature tree, but are nevertheless unmistakably of this species as is the type of *S. longistipulata* in which the foliage is in a yet more immature stage.

Shorea kuantanensis *sp. nov.*

S. faguetianae HEIM affinis lobis calycis in fructu quam fructus brevioribus lamina nervis lateralibus utrinsecus 8-9 differt.

Medium sized tree. Twig apices and leaf buds sparsely buff puberulent, ovary densely so. Twig c. 2 mm ϕ apically, terete, striated. Leaves 7.5-12 by 2.7-5 cm, lanceolate, thinly coriaceous; base cuneate, subequal; acumen to 1 cm long, slender, margin subrevolute; nerves 8-9 pairs, slender but elevated beneath, obscurely depressed above; tertiary nerves reticulate; midrib prominent beneath, hardly elevated above; petiole 15-18 mm long, slender. Panicles and flowers unknown. Fruit pedicel to 4 mm long, expanding into the fruit base; calyx lobes to 22 by 4 mm, subequal, linear except at the expanded incrassate saccate base; nut to 25 by 11 mm, narrowly ellipsoid, acute, exceeding fruit sepals.

HOLOTYPE: Kep 31771, Bukit Goh F. R., Kuantan, E. Malaya. (KEP).

OTHER COLL.: Kep, 31806, Bt. Goh F. R.

This curious little tree will probably never be collected in flower; the fertile basalt soils of Bt. Goh forest reserve, east Pahang, on which it grew now support a cover of *Elaeis guineensis* JACQ.

***Shorea chaiana* sp. nov.**

S. longispermae ROXB. *S. obovoideae* SLOOT. affinis lobis calycis in fructu brevibus subequalibus lamina basim versus inaequali costa media supra manifesta differt.

Large buttressed tree. Petiole, panicles, perianth outside and ovary persistently $\pm$ densely cream-buff puberulent; sepals, twig and leaf nervation below sparsely $\pm$ caducously so; other parts glabrous. Twigs c. 1 mm ϕ apically, much branched, terete, becoming smooth, dark brown. Buds minute. Leaves 6–11 by 2–4 cm, elliptic-lanceolate, $\pm$ distinctly falcate, subcoriaceous; margin subrevolute; base cuneate or obtuse, subequal; acumen to 15 mm long, slender, caudate; nerves 8–11 pairs, slender but prominent beneath, evident above, arched; tertiary nerves reticulate, distinctly elevated beneath; midrib prominent and terete beneath, evident but appanate to shallowly depressed above; petiole 5–8 mm long, short, slender. Panicle to 6.5 cm long, terminal or axillary, slender, singly branched; branchlets to 2 cm long. Flower buds to 5 by 2 mm, lanceolate. Sepals broadly ovate, subacuminate, subequal. Stamens 15; filaments expanded and gibbous in the basal $\frac{1}{2}$, filiform distally; appendages acicular, c. $2\frac{1}{2}$ times as long as the narrowly ellipsoid 2-locular anthers. Ovary ovoid-conical, surmounted by an equally tall columnar puberulent stylopodium and shorter glabrous style. Mature fruit unknown; sepals ovate, subequal; ovary ovoid.

DISTR. Malesia: Northern Borneo (C. and N. E. Sarawak). Local, in Mixed Dipterocarp forest below 1000 m.

HOLOTYPE: S. 29722 (Suib) S. Spanggil, Kapit, Sarawak (K).

OTHER COLL.: Sarawak: S. 29517, Ulu S. Sekentut, Kapit; S. 29632, Ulu Balleh, Kapit; S. 29626, S. Mengiong, Balleh.

The leaves somewhat resemble those of *S. longisperma* ROXB. though the tomentum beneath is more sparse, the base unequal and besides, the fruit calyx lobes are short and unequal. The leaf base and tomentum also differentiates it from *S. obovoidea* SLOOT.

***Shorea tenuiramulosa* sp. nov.**

S. angustifoliae ASHTON *S. maximae* (KING) SYM. affinis paniculis – 18 cm longis gracilibus petiolis – 20 mm longis gracilibus epilosis differt.

Small to medium sized tree. Panicles caducous greyish puberulent; bracts persistently so, parts of petals exposed in bud and ovary persistently densely so. Twigs 1–2 m ϕ apically, terete, pale greyish brown, rugulose. Buds and stipules not seen. Leaves 9–24 by 4–11 cm, elliptic to lanceolate, thinly coriaceous, drying pale greyish brown; margin undulate, somewhat revolute; base broadly cuneate to obtuse; apex shortly broadly acuminate; nerves 8–9 (–11) pairs, arched, at 55° – 66° , very slender but distinctly elevated beneath, slightly so above as also the laxly reticulate tertiary nerves; midrib prominent on both surfaces; petioles 11–20 mm long, drying cream-brown at the ends, otherwise blackish. Panicles to 18 cm long, terminal or to 3-axillary or ramiflorous, slender, many flowered; doubly branched, branchlets to 2 cm long; bracts to 2 mm long, elliptic, fugaceous. Flower buds to 5 by 2 mm. Sepals ovate-deltoid, incrassate, subacute, glabrous, subequal. Stamens 15, in 3 unequal verticils; filaments dilated at base, tapering and filiform distally; appendages slender, villous distally, c. $1\frac{1}{2}$ times as long as the

narrowly ellipsoid anthers. Ovary ovoid, tapering into the somewhat shorter stout columnar style; style villous in the basal $\frac{1}{2}$. Fruit pedicel to 2 by 2 mm; sepals to 6 by 5 mm, equal, ovate, subacuminate, thickened; nut to 25 by 8 mm, fusiform-lanceolate.

DISTR. Malesia: N. E. Borneo (E. Sabah, Sakar Island). Local on dry rocky ultrabasic ridges near the coast.

HOLOTYPE: San 39306, Bukit Meliau, Karamuak, E. Sabah (K).

OTHER COLL.: San 54801, 21621, 21626, 36031, Look Megulang, Pulau Sakar, San 21475, Mt. Silam, Lahad Datu.

Clearly allied to *S. angustifolia*; the rather broad chartaceous leaf, curling over irregularly at the margin and with matte undersurface, and the long and slender epilose petiole cream coloured only at the distal end, serve to distinguish it.

Shorea longisperma ROXB. Hort. Beng. (1814) 93 *nomen nudum*; Fl. Ind. Careys ed. 2 (1832) 618; DC. Prodr. 16, 2 (1868) 632; BRANDIS J. Linn. Soc. Bot. 31 (1895) 103; RIDL. Fl. Mal. Pen. 1 (1922) 143. — *Parashorea longisperma* KURZ J. R. As. Soc. Beng. Sc. 39, 2 (1870) 66; DYER Fl. Br. Ind. 1 (1874) 441; SLOOT. Bull. Jard. Bot. Btzg III, 8 (1927) 571; FOXW. Mal. For. Rec. 10 (1932) 226.

HOLOTYPE: Roxburgh s.n., Prince of Wales Island (BR).

— *Shorea resinanegra* FOXW. Mal. For. Rec. 10 (1932) 205; BURK. Dict. 2 (1935) 204; SYM. Mal. For. Rec. 16 (1943) 56; ASHTON Man. Dipt. Brun. Suppl. (1968) 89.

HOLOTYPE: Kep. 24205, S. Lalang F. R., Ulu Langat (KEP).

The type of *S. longisperma* has for long remained lost and a mystery; Symington surmised that it might represent *S. curtisii* DYER ex KING. Thanks to a tip-off from Professor Van Steenis I have rediscovered it hidden in the Brussels herbarium among the Roxburgh collections. It proves to consist of fruits only, but unmistakably those of *S. resinanegra* FOXW.

Shorea hopeifolia (HEIM) SYM. Gard. Bull. S. S. 8 (1933) 150; *ibid.* 8 (1934) 36; Mal. For. Rec. 16 (1943) 52; BROWNE For. Tr. Sarawak and Brunei (1955) 163; MEIJER & WOOD Sab. For. Rec. 5 (1964) 73; ASHTON Man. Dipt. Suppl. (1968) 84. — *Cotylelobium? hopeifolium* HEIM Bull. Soc. Linn. Paris 1 (1891) 971; BRUHL & KING Ann. R. Bot. Gard. Calc. 5, 2 (1896) 153; BRANDIS J. Linn. Soc. Bot. 31 (1895) 95. — *S. ridleyana* KING J. R. As. Soc. Beng. Sc. 62, 2 (1893) 115 p.p.; SLOOT. ex MERR. Pl. Elm. Born. (1929) 204; RIDL. Fl. Mal. Pen. 1 (1922) 226 p.p.; FOXW. Mal. For. Rec. 3 (1927) 353; *ibid.* 10 (1932) 209 p.p. — *Hopea heimiana* BRANDIS J. Linn. Soc. Bot. 31 (1895) 63; MERR. En. Born. (1921) 402. — *H. albescens* RIDL. J. Str. Br. R. As. Soc. 73 (1916) 142; Fl. Mal. Pen. 1 (1922) 236. — *S. kalunti* MERR. Philip J. Sc. 26 (1925) 475; DESCH Mal. For. Rec. 12 (1936) 35, 39; FOXW. Philip J. Sc. 67 (1938) 307. — *H. hopeifolia* SLOOT. Bull. Jard. Bot. Btzg III, 10 (1929) 396.

Symington has already discussed the synonymy of this species. I add *S. kalunti* MERR., based on F.B. 27701 (Angeles and Hilario) Banauan, Davao Prov., Mindanao in fruit (isoholotype in K). It shares the somewhat larger leaf, lacking domatia and with more remote tertiary nerves, that also prevails in N. W. Sabah, but the densely cream flocculent pubescent inflorescences, flowers and fruits are characteristic of *S. hopeifolia*; this species therefore occurs in Malaya, Sumatra, Borneo and in Mindanao.

Symington considered the pair of porous domatia on either side of the base of the midrib as a diagnostic character in Malaya; it is usually absent in Borneo however, as in Mindanao.

Shorea assamica DYER Fl. Br. Ind. 1 (1874) 307; BRANDIS J. Linn. Soc. Bot. 31 (1895) 85; Ind. Trees (1911) 70; FOXW. Philip. J. Sc. Bot. 4 (1909) 516; TROUP Ind. Woods and Uses (1909) 241; Silv. Ind. Trees (1921) 133; GAMBLE Man. Ind. Timb. (1922) 83; PEARSON & BROWN Commer. Timb. Ind. 1 (1932) 119; KANJILAL & DAS Fl. Assam (1934) 136; PARKINSON Ind. For. Rec. (Bot.) 1 (1937) 40; SYM. Gard. Bull. S. S. 9 (1938) 331.

Ssp. globulifera (RIDL.) SYM. Gard. Bull. S. S. 9 (1938) 331; Mal. For. Rec. 16 (1943) 31. — *S. globifera* RIDL. Fl. Mal. Pen. 1 (1922) 232; FOXW. Mal. For. Rec. 3 (1927) 35; *ibid* 10 (-932) 191; BURK. Dict. 2 (1935) 2010; SYM. *ex* DESCH, Mal. For. Rec. 12 (1936) 27. — *Shorea sororia* SLOOT. Bull. Bot. Gard. Btzg III, 18 (1949) 247.

I follow Symington's interpretation (1938) of this species except that *Ssp. koordersii* is now recorded from Luzon (Rojo 100, BBLC1, Bislig, Surigau del Sur, Mindanao). Van Slooten (Reinwardtia 2 (1952) 42) could not bring himself to accept such a wide concept of this species. He recognized that *S. globifera* RIDL. occurs in Sumatra yet described *S. sororia* based on b.b. 31387, Perhutan Lajan, Tapanuli, W. Sumatra (BO), from there also without defining the differences between the two species; indeed, he did not even comment on their similarity. I am unable to separate *S. sororia* SLOOT. from *S. assamica* DYER *ssp. globifera* (RIDL.). SYM. on any character.

Shorea virescens PARIJS in Fedde, Rep. 33 (1933) 244; Kennis Oost-Ind. Damarhars (1933) 120; SLOOT. Bull. Bot. Gard. Btzg III, 18 (1949) 240; ROJO Kalikasan 5 (1976) 99.

HOLOTYPE: b.b. 13898, Sanggau, West Borneo (L).

— *S. lamellata* (non FOXW.) ASHTON Man. Dipt. Brun. (1964) 164 *p.p.*; *ibid* Suppl. (1968) 94 *p.p.*

Twig, panicle, bud, stipule, petiole, midrib (both surfaces) and nervation beneath shortly densely persistently grey-buff tomentose. Twig 2.5–4 by 1.5–3 mm, compressed, becoming finely cracked; stipule scars *c.* 2.5 mm long, glabrous, horizontal. Bud 2–3 by 4 mm, globose to stoutly ovoid, obtuse. Stipule to 25 by 3–4 mm, linear, acute. Leaves alternate, 8–15 by 4–8 cm, obovate; base subcordate; acumen to 7.5 mm long; nerves 20–26 pairs, at 90° at base, *c.* 40°–55° along the midrib; tertiary nerves very slender, scalariform, dense, at 90° to the nerves; petiole 1.5–2 cm long. Panicle to 10 cm long, terminal or axillary, ± compressed, slender, straight; unbranched or singly branched; bracteoles to 8 mm long, narrowly lanceolate, densely pubescent outside, puberulent within, caducous. Flower buds to 6 by 3 mm, ellipsoid, obtuse. Calyx densely puberulent outside, glabrescent within; 3 outer lobes ovate, subacute; 2 inner lobes shorter, smaller, thinner, ovate-acuminate. Petals narrowly lanceolate, densely pubescent on parts exposed in bud. Stamens 15, of 2 lengths; filaments broad at base, tapering and filiform distally; anthers narrowly oblong; appendage to connective about twice length of anther, exceeding style apex. Ovary ovoid, minutely puberulent; style filiform, as long as ovary, distinctly trifid. Fruit calyx shortly puberulent or glabrous when mature; 3 longer lobes to 8 by 1.3 cm, spatulate, ± obtuse, to 6 mm broad above the to 8 by 7 mm elliptic somewhat thickened saccate base; 2 shorter lobes to 5.5 by 0.5 cm, linear, similar at base. Nut to 1.3 by 1 cm, glabrescent; style remnant to 3 mm long, tapering.

DISTR. Malesia: Borneo, Philippines (Mindanao, Samar).

I had earlier confused this species with the next, now given formal description for the first time. *S. virescens* differs in its compressed persistently grey-buff pubescent twigs and obovate leaves with at least 20 pairs of nerves. Mr. J. ROJO has provided the first records of this species from the Philippines, and the following collections now exist: Mindanao: Rojo CLP 102; PICOP concession, Nyhalu fall, Surigao del Sur; Rojo CLP 190, DASTECO concession, Davao city; Rojo CLP 88 (young fruit), 76, ADECOR concession, Asuncion, Davao del Norte; Rojo CLP 1553, Sang, Asuncion, Davao del Norte; Lomibao Bel. 176, Monkayo, Davao. S. E. Samar: Medulid 1500, Guinmaayohan forest.

Shorea confusa *sp. nov.*

— *S. virescens* (non PARIJS) ASHTON Man. Dipt. Brun. (1963) 167; *ibid* Suppl. (1968) 95; MEIJER & WOOD, Sab. For. Rec. 5 (1964) 60.

S. virescenti PARIJS affinis ramulis glabrescentibus teretis lamina elliptica costis lateralibus utrinsecus minus quam 18 differt.

Large tree. Leaf bud, panicle, stipule outside, petiole, and very young twig caducous pubescent. Twig 2–3.5 mm ϕ apically, frequently rugulose; stipule scar short, obscure. Bud 3–4 by 2 mm, conical, acute. Stipule c. 8 by 3 mm, linear to deltoid, subacute. Leaves 6–12 by 3.5–8 cm, elliptic to slightly obovate; base obtuse; acumen broad, 0.5–1.0 cm long; nerves (10-) 13–18 pairs, curved, at 90° to nerves; petiole 1–1.5 cm long, c. 1 mm ϕ , rather slender. Panicle to 22 cm long, terminal or axillary, terete, lax; singly or doubly branched, branchlets to 10 cm long, bearing to 6 flowers; bracts and bracteoles unknown. Flower bud to 9 by 5 mm, narrowly ovoid, obtuse. Calyx puberulent outside, glabrous within; lobes equal, narrowly deltoid, obtuse. Petals large, narrowly ovate, acute, puberulent on parts exposed in bud. Stamens 15, in 3 subequal verticels; filaments c. $1\frac{1}{2}$ length of anther, slender, tapering gradually; anthers oblong, tapering; appendage to connective c. $3 \times$ length of anther, reaching $\frac{2}{3}$ length of style. Ovary small, ovoid, puberulent; style stoutly filiform, c. $3 \times$ length of ovary, glabrous in the apical $\frac{1}{3}$, otherwise puberulent, shallowly trifurcate. Fruit pedicel stout. Calyx glabrous; 3 longer lobes to 12 by 1.5 cm, narrowly spatulate, obtuse, hardly tapering, slightly broadening at the thickened saccate base; 2 shorter lobes to 6 by 0.5 cm, unequal, linear, similar at base; base of calyx obconical, tapering into the pedicel. Nut to 2 cm long, ovoid, glabrescent; style remnant c. 6 mm long, slender.

DISTR. Malesia: N. E. Borneo (N. E. Sarawak, Sabah S. E. to Sangkulirang). Scattered, undulating land and hills below 650 m. on leached clay soils in Mixed Dipterocarp forest.

HOLOTYPE: San 19395, Mile 24 Cocoa Estate, Tawau (K).

OTHER COLL.: Sabah: San 9276, Pababag Isles F.R.; San 40334, Mt. Templer P.F., Kota Belud, San A 3522, 16349, 16180, S. 2976, A 2664, 15485, Wyatt-Smith s.n. 12.8.54, s.n. 25.5.54, Kep. 35607, 55175, 55340, 48863, Kabili-Sepi'ok F.R.; San A 3691, A 3663, A 4148, Kalabakan, Tawau; San 16592, Ulu Moyah, Sipitang; San 16108, Sabahan R., Lahad Datu; San 15027, Masuli-Koyah F.R., Lahad Datu; San A 4233, Bt. Garam, Kinabatangan; San 4948, Kep. 41085, Supu, Sandakan; Wyatt-Smith s.n. 16.8.54, Dalas; s.n. 16.8.54, Tamparuli; Kep. 38816, Mile 15, Sandakan; Kep 38690, Sekong valley, Sandakan; Kep. 28768, Bettotan, Sandakan; Kep. 80479, South of Talibong, Kota Belud. Sarawak: Kep 79343, Lambir hills; S. 1533, Lawas; S. 23023, Bt. Mentagai, Bok-Tisam F.R.; S. 23307, G. Dulit at Long Atun. Brunei: Kep 30535, Ulu Batu Apoi; Brun 5281, Ulu Belalong at K. Ropan; S. 5641, Peradayan F.R.; Brun 895, Rh. Sigat, Ulu Tutong; Brun 2004, Bangar; S. 1690 S. Belaban, Tutong.

For differences from *S. agami* WOOD ex ASHTON, see ASHTON (1963).

***Shorea dispar* sp. nov.**

S. negrosensis FOXW. affinis lamina 4–7 $\times$ 2–3.5 cm minori staminibus c. 25 aristis antherorum longioribus differt.

Large buttressed tree. Twigs, petioles, bud, panicles, perianth outside and ovary densely $\pm$ persistently pale tawny pubescent, leaf nervation beneath sparsely so. Twigs c. 2 mm ϕ apically, much branched, terete, at first rugulose and $\pm$ ribbed, becoming smooth, dark brown dappled; stipule scars short, dark, horizontal. Buds to 3 by 2 mm, ellipsoid, obtuse. Stipules unknown. Leaves 4–7 by 2–3.5 cm, elliptic, coriaceous, $\pm$ distinctly but sparsely cream lepidote beneath; margin subrevolute; base cuneate; acumen short, broad; nerves 9–11 pairs, ascending, prominent beneath, obscure and narrowly depressed above as also the midrib; petiole 12–16 mm long. Panicle to 8 cm long, terminal or axillary, rigid, ascending; singly or doubly branched, branchlets to 3 cm long. Flower buds

to 6 by 4 mm, ovoid. Sepals broadly ovate, subequal, shortly subacuminate. Stamens c. 25; filaments long, lorate, somewhat tapering to the oblong anthers; appendages c. $\frac{3}{4}$ length of anthers; ovary small, ovoid, glabrous, surmounted by a slender filiform style c. twice its height. Fruit unknown.

DISTR. Malesia: Borneo (C. Sarawak; once collected). Mixed Dipterocarp forest on inland hills.

HOLOTYPE: S. 29208, Ulu Baleh above Nanga Mengiong, Kapit.

Superficially resembling *S. parvifolia* DYER ssp. *velutinata* ASHTON, the flowers betray the close relationship of this rare tree with red lauan (*S. negrosensis* FOXW.), the celebrated timber tree of the Philippines, and assign both to section *Rubellae* ASHTON.

Shorea parvistipulata HEIM Bull. Soc. Linn. Paris, 2 (1891) 974 *Ssp. parvistipulata*. BRANDIS J. Linn. Soc. Bot. 31 (1895) 95; MERR. En. Born. (1921) 406 (*Sphalm. parvistipula*); ASHTON Man. Dipt. Brun. Suppl. (1968) 114; MEIJER & WOOD Sab. For. Rec. 5 (1964) 132.

TYPE: BECCARI 2547, Sarawak (K, P).

— *S. squamata* (non BENTH. & HOOK f.) BRANDIS J. Linn. Soc. Bot. 31 (1895) 92; MERR. En. Born. (1921) 407 p.p. *quoad sp. Born.* — *S. dyeri* (non THW. ex TRIM.) HEIM Bull. Soc. Linn. Paris, 2 (1891) 957. — *S. cristata* BRANDIS J. Linn. Soc. Bot. 31 (1895) 97; MERR. En. Born. (1921) 404; ASHTON Man. Dipt. Brun. (1964) 106; *ibid.* Suppl. (1968) 106; MEIJER & WOOD Sab. For. Rec. 5 (1964) 102.

HOLOTYPE: Beccari 2115, Sarawak (K).

Leaves 6–20 by 3–9 cm, not lepidote beneath; nerves 13–21 pairs; longer fruit calyx lobes to 20 cm long.

DISTR. Borneo (excepting S.W.). Widespread on clay rich soils on alluvium and especially hillsides and low ridges to 1300 m.

I no longer consider that *S. cristata* can be maintained as a separate species. *S. palosapis* (BLCO) MERR. is undoubtedly closely allied but differs in its amplexicaul stipule scars, large deltoid subpersistent stipules, and its oblong irregular crown, branching from low on the bole.

Ssp. nebulosa (MEIJER) *stat. nov.*

— *S. nebulosa* MEIJER Act. Bot. Neerl. 12 (1963) 337; MEIJER & WOOD Sab. For. Rec. 5 (1964) 123.

Partes ut in ssp. *parvistipulata* sed lamina -13×6 cm costis lateralibus utrinsecus minus quam 15; lobis celycis in fructu -9×18 cm differt.

DISTR. N. E. Borneo; Crocker range and Mt. Kinabalu region. Hill forests between 800–1300 m.

HOLOTYPE: San 16355, Paring, Ranau (L).

OTHER COLL.: San. 16273, Ulu Moyah, Sipitang; San A 4378, Keningau; San 17010, 17025, Tambunan; San 16357, Paring, Ranau.

Ssp. albifolia ssp. nov.

Partes ut in ssp. *parvistipulata* sed lamina subtus roseoargentea lepidota differt.

DISTR. Borneo: N. E. Sarawak (Niah), Brunei; S. E. Sabah southwards to to Balikpapan. Fertile soils on undulating land and periodically inundated alluvium.

HOLOTYPE: S. 29276, Ulu Sekaloh, Niah, Sarawak (L).

OTHER COLL.: Brunei: S. 1689, S. Belaban, Tutong; S. 1692, S. Kiaput, Ulu Tutong; Brun 5630, Ulu Pelangaoung, Belait. Indonesian Borneo: b.b. 34918, Sambodja, Balikpapan, S. E. Borneo.

Shorea pauciflora KING J. R. As. Soc. Beng. Sc. 62, 2 (1893) 116; BRANDIS J. Linn. Soc. Bot. 31 (1895) 98; BURKILL J. Str. Br. R. As. Soc. 81 (1920) 51, 69; RIDL. Fl. Mal. Pen. 1 (1922) 228; FOXW. Mal. For. Rec. 3 (1927) 51 *p.p.*; *ibid.* 10 (1932) 218; SLOOT. in MERR. Pl. Elm. Born. (1929) 203; BURK. Dict. 2 (1935) 2020; SYM. Mal. For. Rec. 16 (1943) 78; BROWNE For. Tr. Sarawak and Brunei (1955) 149; ASHTON Man. Dipt. Brun. (1963) 207; *ibid.* Suppl. (1968) 114; MEIJER & WOOD Sab. For. Rec. 5 (1964) 133.

ISOHOLOTYPE: Curtis 1537, Penang Hill (K).

— *S. plagata* FOXW. Philip. J. Sc. 13 (1918) Bot. 192; *ibid.* 67 (1938) 308.

ISOHOLOTYPE: F.B. 13758 (Foxworthy, Demesa and Villamil) Fort Banga, Zamboanga Province, Mindanao (K).

— *S. agsaboensis* W. L. STERN Brittonia 17 (1965) 36; ZAMUCO et al. Forestry leaves, Philippines, 15, 3 (1965) 75.

ISOHOLOTYPE: Stern 2102 Tungao, Agsabo R., Agusan, Mindanao (K, LBC).

The type of *S. plagata* differs from *S. pauciflora* substantially only in the unusually small leaf size and the usual but not universal presence of small axillary domatia up the midrib. Foxworthy described the timber as being a heavy red lauan as is *S. pauciflora* and I have little doubt that they are conspecific, though flowers of *S. plagata* are still unknown and would provide useful confirmatory evidence.

Under *S. polysperma* (BLCO) MERR. Foxworthy (*ibid.* (1938) 309) commented on the presence of a hill form in Laguna and Tayabas (now Quezon) provinces, Luzon, known as Tiaong, with significantly lighter softer wood. I have seen this tree in the field, and am convinced that it represents nothing more than the small-leaved extreme in a continuous range of variation in *S. polysperma*, leaf size increasing down the hillside into the valleys sheltered from the typhoons; larger leaved forms prevail in the everwet forests of southern Luzon to Mindanao. However, the name has also been applied by foresters (from Luzon) to a small-leaved tree in timber concessions in northwest Mindanao which undoubtedly represents *S. plagata* though the leaves are generally somewhat larger than the type and more closely match those of *S. pauciflora* KING. There it also has the reputation of being light-timbered and liable to 'trashy heart', which is not in character with *S. pauciflora*; Zamuco et al. found the wood to be anatomically similar to *S. negrosensis* and *S. polysperma* though paler than the former; they did not compare density. Stern, who also regarded the Luzon 'tiaong' to be either *S. polysperma* or *S. negrosensis* described a fresh species on the basis of Surigao del Norte specimens, under the name *S. agsaboensis*.

This form of *S. pauciflora* is now known from throughout Mindanao including Zamboanga, Lanao, Surigao del Norte, Agusan and Bukidnon (according to Foxworthy, specimens destroyed). Flowers are urgently required to establish its exact status, which may be as a distinct subspecies of *S. pauciflora*.

OTHER COLL.: from Mindanao: Stern and Rojo 2102A, Esmade and Tamesis s.n., 30.8.1963, Lomibao 1436, Tungao, Agusan; Tamesis and others CLP N-69, PNH 40893, Mamato plateau, Misamis Oriental; Rojo CLP 1583, Rojo 1570, NALCO, Agusan Norte (all at LBC).

Shorea singkawang MIQ. Ann. Mus. Bot. Lugd. -Bat. 3 (1865) 87.

Ssp. **singkawang**. BURCK Ann. Jard. Bot. Btztg 6 (1887) 219; BRANDIS J. Linn. Soc. Bot. 31 (1895) 87; HEYNE Nutt. Pl. ed. 1, 3 (1917) 307; *ibid.* ed. 2, 2 (1927) 1125; FOXW. Mal. For. Rec. 10 (1932) 164; BURK. Dict. 2 (1935) 2022; SYM. Mal. For. Rec. 16 (1943) 92. — *Hopea singkawang* MIQ. Sum. 1 (1860) 489, 191; DC. Prodr. 16, 2 (1968) 635; WALP., Ann. 7 (1868) 379; HEYNE Nutt. Pl. ed. 2, 2 (1927) 1125.

HOLOTYPE: Teysmann s.n., Sidjungjung, Sumatra (U).

— *S. thiseltoni* KING J. R. As. Soc. Beng. Sc. 62, 2 (1893) 122; BRANDIS J. Linn. Soc. Bot. 31 (1895) 265; BRUHL & KING Ann. Bot. Gard. Calc. 5, 2 (1896) 155; BURKILL J. Str. Br. R. As. Soc. 86 (1922) 285; HEYNE Nutt. Pl. ed. 2, 2 (1927) 1125. — *S. forbesii*

KING *ex* BRANDIS J. Linn. Soc. Bot. 31 (1895) 77, *nomen in syn.* — *Pachychlamys thiseltoni* RIDL. Fl. Mal. Pen. 1 (1922) 233; Fl. Mal. Pen. 3 (1927) 38. — *P. beccarianus* (non DYER *ex* BRANDIS) RIDL. Fl. Mal. Pen. 1 (1922) 233.

Young twigs, petioles, midrib and fruit calyx caducous ochrous-buff puberulent; panicles, parts of perianth exposed in bud and nut persistently so. Leaves (8-) 12-24 by (2.3-) 5.5-9 cm, oblong-lanceolate, coriaceous; base $\pm$ broadly cuneate; acumens to 1.5 cm long, tapering; nerves 7-12 pairs.

DISTR. Malesia: Malaya, Lingga, E. Sumatra (Indragiri, Palembang, Lampung).

Ssp. scabrosa ssp. nov.

— *Shorea sp. C.* SYMINGTON Mal. For. Rec. 16 (1943) 95.

Ramuli gemmae stipulae petioli costa media costae laterales subtus paniculi calyx externusque primo conferte scabrido fulvo pubescentes costae subtus dein sparsim calyx caduce alteris persistente pubescentes. Lamina coriacissima basim versus obtusa vel cordata acumine brevi vel obtusa costis lateralibus utrinsecus 12-17.

DISTR. Malesia: E. Malaya (coastal Pahang, Trengganu, and N. E. Johor).

HOLOTYPE: Kep. 66959, Bukit Bauk Forest Reserve, Dunguan, Pahang (KEP).

OTHER COLL.: Kep. 26729, 26708, 26734, 26740, 26904, 26755, S. Paka, Trengganu; Kep. 44139, Bt. Lonchong, Ulu Paka; Kep. 94931, 93845, 94934, 94943, 94963, Kerteh, Ulu Chukai reserve, Kemaman, Trengganu; Kep. 43058, Dungun; Kep. 31681, 31680, S. Taroh, Lesong F. R., Pahang; SFN 29331, S. Kayu Ara, Mawai-Jemaluang road, Johor.

Shorea curtisii DYER *ex* KING J. R. As. Soc. Beng. Sc. 2 (1893) 111; BRUHL & KING, Ann. R. Bot. Gard. Calc. 52, 2 (1896) 152. — *ssp. curtisii*. BRANDIS J. Linn. Soc. Bot. 31 (1895) 101; RIDL. Agr. Bull. S. S. & F. M. S. 1 (1901) 58; Fl. Mal. Pen. 1 (1922) 223; HEYNE Nutt. Pl. ed. 1, 3 (1917) 299; *ibid.* ed. 2, 2 (1927) 1116; BURK, J. Str. Br. R. As. Soc. 81 (1920) 71; FOXW. Mal. For. Rec. 1 (1921) 78; *ibid.* 3 (1927) 39; *ibid.* 10 (1932) 226; BURK. Dict. 2 (1935) 2009; CORNER, Wayside Trees 1 (1940) 213; SYM. Mal. For. Rec. 16 (1943) 67; BROWNE For. Tr. Sarawak and Brunei (1955) 147; ASHTON Man. Dipt. Brun. (1964) 185; *ibid.* Suppl. (1968) 106; MEIJER & WOOD, Sab. For. Rec. 5 (1964) 103.

SYNTYPES: Curtis 427, 1394, 1395, Penang Hill; Kunstler 8143, Larut, Perak, Malaysia (K).

Twig c. 1.5 mm ϕ apically. Leaves 6-9 by 2.5-3.5 cm, ovate-lanceolate; nerves 9-11 pairs; petiole 10-13 mm long.

DISTR. Peninsular Thailand (Pattani) and in Malesia: Malaya, Singkep, Lingga, Borneo (Rejang valley to S. W. Sabah).

Ssp. grandis ssp. nov.

— *Shorea sp. B.* SYMINGTON Mal. For. Rec. 16 (1943) 95.

Ramuli apices versus c. 4 $\times$ 2 mm ϕ . Lamina 11-17 $\times$ 5-8 cm elliptica costis lateralibus utrinsecus 10-13 petiolo 20-25 mm longo.

DISTR. Malaya: Perak.

HOLOTYPE: Kep. 16276, Ulu Chemor, Kinta hills Forest Reserve, Perak (KEP).

OTHER COLL.: Kep. 85601, Kinta Hills F.R., Kep. 25412, 15440, Upper Chemur valley, Perak; Kep. 32165, 33701, 28981, 25642, 40610, Keledong Saiong F. R. Perak.

This distinct form grows in mixture with the type subspecies in the Perak hills.